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Acceleration of Innovation Processes in the ICT Sector

Master's thesis submitted in partial fulfilment of the requirements for the degree of Master of Science in Technology in the Degree Programme in Engineering Physics.

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Tiivistelmä:

Tämän diplomityön tavoitteena on tutkia Tieto- ja viestintäteknologia (ICT)-sektorin liiketoimintaan keskittyvien innovaatioprosessien nopeuttamista ja niiden menestystekijöitä.

Kirjallisuusosassa on esitelty työhön liittyviä keskeisiä tutkimuksia. Kirjallisuudesta tunnistettiin tekijät, jotka liittyvät oleellisesti työn tavoitteeseen ja näitä tekijöitä on käyty läpi yksityiskohtaisemmin.

Yksittäisen tapaustutkimuksen tuloksia käytettiin kirjallisuustutkimuksen avulla muodostetun kokonaiskuvan analysointiin ja syventämiseen. Tapaustutkimus toteutettiin haastattelemalla niin liiketoimintaan tähtäävän innovaatioprosessin eri toimijoita kuin ulkopuolisiakin ryhmiä.

Lineaarinen ja systemaattinen innovaatioprosessi verkostomaisessa kehitystyössä ei itsessään vähennä uuden liiketoiminnan kehittämiseen käytettyä aikaa tai lisää sen menestymismahdollisuuksia. Sen sijaan rinnakkaisesti tehtävällä kehitystyöllä on myönteinen vaikutus erityisesti prosessin nopeuteen. Tärkeää on myös huomioida edelläkävijöinä toimivien asiakkaiden tarpeet.

Oleellinen tekijä innovaatioprosessin menestymisessä on muodollisten sopimusten solmiminen osapuolten välillä niin aikaisessa vaiheessa kuin mahdollista.

Teknologiainnovaatiossa, joissa liiketoimintamalli perustuu kolmansien osapuolten palveluihin, on kriittinen menestystekijä juuri näiden palveluntuottajien sitouttaminen itse innovaatioon. Nämä kolmannet osapuolet tulee tunnistaa ja sitouttaa kehitystyöhön mahdollisimman aikaisessa vaiheessa.

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Avainsanat: Innovaatioprosessit, Innovaatioverkostot, Liiketoimintainnovaatio, Liiketoimintaekosysteemi

Aalto University School of Science and Technology Faculty of Information and Natural Sciences	ABSTRACT OF THE MASTER'S THESIS
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Abstract:

The goal of this thesis is to study the acceleration and success factors of business model innovation processes within a network of companies in the ICT sector.

In the literature review general perspectives to the field and to the context are presented. Then the factors regarding the speed and the success of innovation processes are studied in more detail.

A case study was used to evaluate, verify and deepen the findings from the literature. The subject of the case study was a network based business innovation development project in the ICT sector. The case study was conducted by interviewing the participants and relevant persons outside the project.

A linear and systematic innovation process, in the context of network development, gives only small input to minimise the throughput-time or to maximise the success of the innovation. Instead, parallel activities and the use of lead users in development work has a positive impact, especially on the speed of the process.

Formal agreement among the participants is an essential factor not only to the success of the innovation, but to the lifespan of the network-based innovation project in the first place. Agreements should be done at the earliest possible phase.

In a technology innovation, where the business model is based on services run by third parties with high end-user penetration, the commitment of the main third parties is crucial for the success of the innovation. The key third parties should be identified and involved in the development process as early as possible.

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Preface

This master's thesis was done at Aalto University School of Science and Technology and at its predecessor Helsinki University of Technology during the period from summer 2009 to March 2010.

The initiator of research agenda and provider of empirical data was Tivit Ltd., to which I hope this work and its results are of value.

I would like to thank my supervisor, Professor Ahti Salo, and instructors Ph.D. Marja Toivonen and M.Sc. (Tech) Reijo Paajanen for their considerable guidance and support. I am much obliged to my brother Ville, M.Sc. (Tech), for his encouraging words and also his effort on proofreading and commenting. I, however, bear the sole responsibility for all defects and deficiencies of this work, wherever they might be.

The most affectionate acknowledgement goes to my dear Laura, whose invaluable help was crucial in all the phases of this project, from the start to the finish.

Helsinki, 4^{th} of March,

Mauno Taajamaa

Table of Contents

1 Introduction

1.1 Background

We are living in turbulent times, as world and business around us is changing rapidly and chaotic manner in many ways. Accelerated disruptions in business conditions are reality to today's managers and decision makers, when regulation, technology, customers and competitions are all changing globally (e.g. Cooper and Edgett 1999). To this imbroglio innovation is offered as a remedy, in the context of an individual firm or even a whole nation. The old, but still widely used classic dictum or maxim to companies is to "innovate or die (or perish)" (e. g. Robertson 1967). This is truly a Schumpeterian world where innovation as a phenomenon is the central power of economic growth. You either create new value with new innovations or trickle into oblivion – a "creative destruction" as Schumpeter expresses so well (Schumpeter 1934). He emphasises that *"in dealing with capitalism we are dealing with an evolutionary process"* (Schumpeter 1942, 82). As Foster and Metcalfe (2001) put it *"capitalism in equilibrium is contradiction in terms"* (Ibid., 6). In capitalism innovation is therefore the key engine in economic growth, competitiveness and employment (e.g. Rametsteiner and Weiss 2006). In this struggle it is widely accepted that only those nations, firms and persons will be successful who can outstand as innovative and creative among their peers (e.g. Veugelers, et al. 2009). For nations the task is to create an atmosphere and culture which nurses innovation among companies and citizens. This is true, for instance, in Finland, where innovation policy is sought after, evaluated and criticised in constant rate in belief that only by exceeding our rival countries can we obtain and retain the life-style and welfare that has been created after the Second World War (e.g. Veugelers, et al. 2009).

A Kuhnian (Kuhn 1970) paradigm shift has also occurred in the last two decades from single-company innovation development to network of companies doing co-operation in developing innovations. Larger firms have been disaggregated into networks of more specialised, autonomous departments or even independent firms of smaller size, in the pursuit of encouraging more entrepreneurial culture (Ashkenas, et al. 1995, Hagel and Singer 1999). Companies co-operate in specific project and at the same time compete fiercely in different market. Strategic alliances, joint ventures, licensing, outsourcing and collective research organisations are all more common today and give a wide variety of collaboration choices to choose from the most suitable for each occasion (Schilling 2008). In Finland also collaboration among companies and research facilities, such as universities, and the government funding institutes is more and more prevailing tendency. A good example of this are the Strategic Centres for Science, Technology and Innovation or so called SHOK instruments, which are coordinated by TEKES and Research and Innovation Council (The Science and Technology Policy Council of Finland 2008). To these instrument coordinators, such as Tivit Ltd. in ICT SHOK, the innovation process is a critical element in their activities. Basic research has its value by itself, but for the majority of financiers the focus is more on applied and commercialised inventions – innovations in other words. How these inventions are taken to commercial success, is a question of high significance. This thesis tries to give some contribution to this mission.

Innovations, as all popular or buzz terms, can be understood to be differently depending on orators' or audiences' perceptions. Because *innovation* as a term is used so broadly in so many different contexts, there is real risk of obscurity and as a result a credibility gap in a scientific perspective. As Achrol (1997) describe the dilemma: "*popularity in usage is of course a mixed blessing: it makes the subject matter worthy of greater scholarly attention but encourages conceptual ambiguity and the risk of premature obsolescence due to overuse*" (Ibid., 59). To tackle this, various definitions of innovation must be considered, and with rational reasons one of them is to be chosen as a founding premise before continuing forward.

Innovation is, in one short definition, just to create or invent something unique and then also implement or apply it successfully (e.g. Mickeown 2008). Schumpeter (1934) defined it quite broadly as new combinations of means of production, emphasising the discontinuous manner of this action. Rogers (2003) says innovation to be "*an idea, practice, or object that is perceived as new by an individual or other unit of adaption*" (Ibid., 12). He defines the novelty of innovation depending on factors such as knowledge, persuasion, or decision of adopt, but he does not consider the process perspective. This kind of perspective is adopted by Van de Ven (1986), who define innovation as *"the development and implementation of new ideas by people who over time engage in transactions with others in an institutional context"* (Ibid., 590). The process view is important because it encompasses the adoption and the use of new techniques, methods or technologies. Thus, this thesis takes the idea of *innovation as a process* as its starting point.

Innovations take different forms. One, and perhaps the most familiar one, is of a technological breakthrough that introduces something radical and unforeseen product to masses – a clear path from an invention such as Usher (1954) describes. In this thesis, different perspectives to innovation in general are introduced, but the main emphasis is on *business model innovations*, where companies in a network forge a new future market with only some or even little technological development. In this context, the rapidness of innovation process is a critical success factor, because business model innovations are more easily imitated than e.g. product innovations. Thus the appropriability of innovation, meaning the degree to which a firm is able to capture rents from its innovation, is determined mainly by the time of entry and first-mover advantages (Schilling 2008).

1.2 Basis, Scope and Research Questions

The fundamental idea of this thesis is to examine what speeds up innovation process and how to anticipate the success of innovations beforehand in business network environment. The basic assumption and premise of this quest is that although new ideas and inspirations presumably happen with an irregular and stochastic frequency, the follow-through of these inventions to productive instances is nothing but uncontrollable. This follow-through or implementation in this thesis is understood and defined to be the *innovation process*. This process begins with a new idea which, by assessment at least by some, seems to have a potential for economic opportunity. The path onwards is can be complex and unique according all the circumstances that affects the innovation in question, but in the process, not as much in the original idea itself, must be found some elements that are essential and common to all successful processes. This assumption leads to the question about the definition of a successful process. In the literature, the basic criterion of a successful project in general is that time, budget and specification are met (Wateridge 1998). Central goals are 1) maximising fit to customer needs; 2) minimising the development cycle time; and 3) controlling development cost (Schilling 2008). Naturally, with an infallible logic one could suggest that if a project or process consumes less time and money, often with more features that fulfil or exceed the customers' needs, the process can definitely be seen as a success story. Due the limited scope this thesis, it focuses on one of these three factors – the speed of the process – which is then subjected to an in-depth examination.

Another perspective is that in the portfolio of innovation processes, the difference between the potentially successful and unsuccessful processes is important to the manager or owner of the portfolio. In a state-gate process of innovation management, like in the case presented, the decision to continue a particular innovation is presumably based on the expected success of that innovation at the end. In this thesis, the factors that affect the eventual success of an innovation are considered and some suggestions are presented.

The scope of this thesis is a certain business area: information and communications technology (ICT) sector. Within this context, networks of companies are taken under review. Networks are categorised in this work as *business ecosystems*, environments where interconnectedness and continues co-evolving are dominating features. The scope is defined so that the characteristics of the accelerated innovation process are analysed in-depth and the case presented is thoroughly examined for insights and themes. The general applicability or proof of our findings to wider context of industries and to different, not network-based, innovation processes is not sought-after in this thesis.

The research questions for this thesis are the following.

i. What factors affect the throughput-time of a business model innovation targeted to create a new business ecosystem in the ICT sector?
ii. What factors create a successful new business ecosystem in the ICT sector and how can these factors be used in evaluating the ecosystem propositions?

1.3 Methodology

This thesis uses so called Case Study Approach, based on Yin's (1981, 1984, 2003) work and clarified by Eisenhardt (1989). In the application of this approach the target is not grounded theory (Glaser and Strauss 1967), i.e. developing and emerging a new theory from wide range of data, but *"understanding the dynamics present within a single setting"* (Eisenhardt 1989, 534). Anwers to the research question presented in the previous chapter are given on that basis.

This is a single case study, which represents a good example of the scope of this thesis and enables the examination of the research questions. The case study was conducted with fidelity and subtlety in all details and with multiple angles for achieving necessary validity and reliability.

The case study approach is tightly linked to qualitative research methodology. The implications and discussion of the case are reflected to the framework drawn from literature and conclusions about these findings are presented. The second research question was studied by a descriptive method reflecting the impact of success factors from the literature and from the case. On the whole, this thesis does not provide an unbiased quantitative assessment of factors impacting on the speed of innovation process or on the success of projects in general. Instead, it focuses on qualitative analysis and viewpoints from a single representative case. The case was selected by its nature as a pilot project for an innovation creation procedure newly created in the ICT SHOK -company, Tivit Ltd. This procedure was constructed, and still developed, in the pursuit to speed up and minimise the throughput time needed to run an innovation project from start to finish; therefore the procedure and the pilot project are relevant to the context of this thesis.

Yin (1984, 2003) presents three principles of data collection to achieve necessary credibility in case studies. The first is the triangulation method for the validity and reliability of the thesis. It is used also in this work. Triangulation method is by definition searching converging findings from different sources and thus increasing the validity of the thesis (Yin 2003). In general way, this was achieved by using both literature and empirical data (case work). In the case, the information was gathered from all the participants and also from relevant outsiders with little or no "biased incentive". The second principle is to gather case study information in a database to be clearly investigated later on. This was done by the author in the following ways:

- all interviews were recorded in a digital form;
- all interviews were transliterated with no filtering and stored accordingly;
- all case study documents were used, stored and referenced accordingly.

The last principle by Yin (2003) is to maintain the chain of evidence. This means that the link from the initial research question and case procedure are pointed out in the case study protocol. This is used also in the literature section where each paragraph is motivated by a single reference to the whole picture. Also the results drawn by the author are based and referenced to relevant citation.

Discussion and criticisms about the results are presented as well as some possible future research topics for expanding the research results.

1.4 Structure

This thesis consists of three main parts: first, a literature review, where the relevant theories of past and present are investigated; and second, the case study, where a specific innovation process functionality is analysed as one model, and then its application is studied in a real world business project; third, the results based on the two previous sections. At the end, discussion and criticism about the discoveries are presented with scientific and managerial implications, and with recommendations for future research. Last, but not least, a summary of the whole thesis is presented.

The literature review comprises of the following content. First a view of the context in question is portrayed in Chapter 2.1, both in general and in more precise conceptual terms relevant to the case study presented later on. Then in Chapter 2.2 key perspective to innovation process in general is presented and the main innovation concepts are described. The subsequent chapters create the theoretical framework concerning the research questions defined: Chapter 2.3 regarding the speed of innovation process and Chapter 2.4 regarding the success of it.

The case study is presented first by describing the premise, the starting point and the progress of the case. Then the results drawn from different sources are presented with discussion and criticisms. At the end, conclusions with implications to different fields – including future research areas – are illustrated with a tight and compact summary.

2 Literature Review

2.1 Networks in Innovation

This thesis is focused on studying innovation process not in an individual company but within a network of companies. Thus, it is important to clarify what the characteristics of networks in innovation are and what different perspectives does the literature offer in describing this context.

Business networks can be found in vertical value-chain processes or in emerging innovation processes (Rampersad, Quester and Troshani 2009). Networks in general are hard to categorise comprehensively, as Iacobucci (1996) describes them broadly *"as being a set of actors and the relational ties among them"* (Ibid., 392; quoted in Rampersad, Quester and Troshani 2009). The ontology of networks in literature has branched off to two different directions. The first sees networks as *"borderless, self-organizing systems that emerge in a bottoms-up fashion from local interactions"* (Möller and Rajala 2007, 896), and the second argue that there exist intentionally created "strategic networks" or "value networks" (Möller and Rajala 2007, Brandenburger and Nalebuff 1996, Parolini 1999). These latter ones can therefore be managed by a single company at least to some extent where as the former see networks as complex adaptive systems that emerge from interaction between organisational and social relationship with poor manageability (Stacey 1996, Lewin 1999). Powell (1990) sees networks as relational, reciprocal and interdependent organisational forms, where partners in the network co-design or co-produce or even bundle new products and services.

Companies are innovating in networks instead of in-house mainly because R&D initiatives are more complex, development time and cost are increasing, product life cycles are decreasing, globalisation is expansive and resources of skilful researchers are scarcer (Tushman 2004, Gulati 1998). By networking and collaborating a company can obtain resources and necessary skills more quickly than in-house development (Chan, et al. 1997). Complementary assets can be critical to success especially when cycle time is fast – in-house development takes time to build these assets, but by strategic alliances or by licensing these assets can be acquired rapidly (Hamel, Doz and Prahalad 1989, Venkatesan 1992). By using partners as sources of necessary capabilities company can reduce its commitment to fixed assets and thus increase its flexibility. This is especially important in the ICT sector where rapid technological change is a fact and assets can become obsolete quite fast (Schilling 2008). Networking can also bring a learning aspect to companies, because close connections with firms facilitate information exchange and learning within companies and also create new knowledge that would not occur if companies work by themselves (Mowery, Oxley and Silverman 1998, Rosenkopf and Almeida 2003, Liebeskind, et al. 1996). Of course, one reason to create networks or alliances is to reduce cost and risk to particular company – this is a major factor above all in projects that are expensive and where the outcome is highly uncertain (Hagerdoon, Link and Vonortas 2000). Networking can also be used to create shared standards, which can be critical in the field where compatibility and complementary goods play a significant role in the success of new innovations. This is usually done by collaboration with big enough group of key players in the field (Schilling 2008).

Many innovation initiatives in networks have failed and thereby networks can be deemed, at least by some, as a drain of resources (Hedaa 1999). Still, it is seen that the ability to exploit external knowledge is a critical component of successful innovations (Cohen and Levinthal 1990) and one way to acquire this is to exploit the wider recourses of a network. Ritter and Gemunden (2003) argue that network competence, *"the ability to handle, use, and exploit interorganizational relationships"* (Ibid., 745), is the key to competitive advantage. In strategic perspective, adopters of network strategy have bigger change to benefit a first-mover advantage in securing resources, gaining market position and political influence, controlling information, and creating new cooperative arrangements (Miles and Snow 1984). Chesbrough and Teece (1996) argue that using networks in innovation is beneficial only depending on the case in question; they present a rule of thumb:

> *"When innovation depends on a series of interdependent innovations - that is, when innovation is systemic - independent companies will not usually be able to coordinate themselves to knit those innovations*

together. Scale, integration, and market leadership may be required to establish and then to advance standards in an industry." (Chesbrough and Teece 1996, 68)

In the network innovation, the interaction between the clients' and network of providers' technology cannot be forgotten (de Vries 2006). This leads to the appropriability question concerning networks (Atkins 1998) which has implications also to the success and speed of innovations.

Tuomi (2002) introduces a concept of social and cognitive innovation that is based on the open source networking in the Internet world. In the fast and highly connected world networking and collaboration are more visible and is the dominant practise. Tuomi also portrays, although not as his key finding, the use of the communities where non-monetary-value incentives can enhance the speed of innovation development. As an example of this Tuomi presents NASA's use of Internet volunteers to mark craters on pictures of Mars, over 1.9 million craters were marked by people in just 7 months – a speed that NASA's experts by themselves could not achieve (Ibid., 12).

As a synthesis, networking has implications both to the speed and success rate of innovation process. Mainly the effect is seen as positive but case-dependent, meaning that networking can also have a serious negative effect in both of these attributes. An example of this is when complexity of the network drains the speed and creates ambiguity in intellectual property rights ending to project altogether. But as business network is defined the context of this thesis, the effects of networking to the speed and success of innovation process are not scrutinised more due the lack of comparative information considering the case in question and the selected scope of this thesis.

2.1.1 Economic Value Networks

One tenet of this thesis is that companies participating within the network can simultaneously be competitors and still be partners for creating a common innovation.

Ray Noorda, CEO for Novell Inc in the 80's, coined the term co-opetition, which simultaneously encapsulates co-operation and competition. Brandenburger and Nalebuff (1996) explain co-opetition among companies as, on the one hand, to create or increase the total market potential by co-operating open-mindedly and then on the other hand, to compete to gain its own share. Company has *"Value Net"* – comparing to value chain thinking – where each player is as a customer, a supplier, a competitor or a complementor to each other. The difference between a competitor and a complementor is the way customer values its products relative to your own. In the former case customer values your product *less* when they have player's product comparing that they have your product alone and in the latter case customer values you product *more* with the player's product. The novel notion that Branderburger and Nalebuff present is to discover and utilise company's complementors either by doing them by yourself or forming an alliance or even setting up a proprietary business. Moore (1993) gives a similar advice to work cooperatively and compete fiercely to satisfy customers' needs. Merry and Kassavin (1995) describe the same: *"In the evolutionary process, cooperation and competition complement each other"* (Ibid., 175).

The one leading idea by Brandenburger and Nalebuff is *"added value"* that the company has in the *"Value Net"* – this amount determinates which proportion the company can attain from the total market. To maximise your own added value and to minimise other players', especially your suppliers', added value is the main strategic task.

2.1.2 Business Ecosystem

Business Ecosystem is an essential concept of this thesis regarding the way that companies network and drive common innovation process. This concept is used widely in the case described in Chapter 3.

Business ecosystem is concept originally created by James F. Moore in the 1990s as a horizontal integration trend where companies in variety of industries create a network to promote a common goal; – pre-eminently one company in this network has a dominating role (Moore 1993, 1996). Examples of eminent business ecosystem are Microsoft's network in software and Wal-Mart's in retail grocery business. In these networks thousands of other companies focus and build their business to the keystone company's common assets and rely on it (Iansiti and Levien, Strategy as ecology 2004). This dominant player is highly connected and is the centre for the ecosystem (Power and Jerjian 2001). Moore (1993) defined that inside business ecosystems companies work cooperatively and competitively to support their products, satisfy customer needs and create new innovations. Moore also sees companies not only as parts of some industry *"but as part of business ecosystem that crosses variety of industries"* (Moore 1993, 75). Iansiti and Levien (2004) introduce different roles to the companies inside the business ecosystem. The most important player in the business ecosystem is defined to be the *"Keystone"*, which serve as enablers for the whole ecosystem to function. *"Niche players"* are largest by quantity, but serve just particular function inside the business ecosystem. *"Dominators"* on the other hand are those who drain value from the network but do not return anything.

Peltoniemi (2006) defines other essential characteristics of a business ecosystem regardless of the industry in question. She emphasises interconnectedness as a dominant feature explaining that in a business ecosystem large number of interconnected participants *"depend on each other for their mutual effectiveness and survival"* (Ibid., 11). Iansiti and Levien (2004) point out that in a business ecosystem each member shares, regardless of individual strength, the fate of the network as a whole. Lewin (1999) describes the one benefit from of being a member of a business ecosystem is that then members are more protected from potential invaders. Peltoniemi (2005b) sees that feedback, which is caused by interconnectedness, is a key force enabling all processes within the business ecosystem. She also connects the Darwinian view that conscious variation by new innovations, selection by the market processes and development in the market are all in one reciprocal relationship with each other as depicted in Figure 1 (Peltoniemi 2005a).

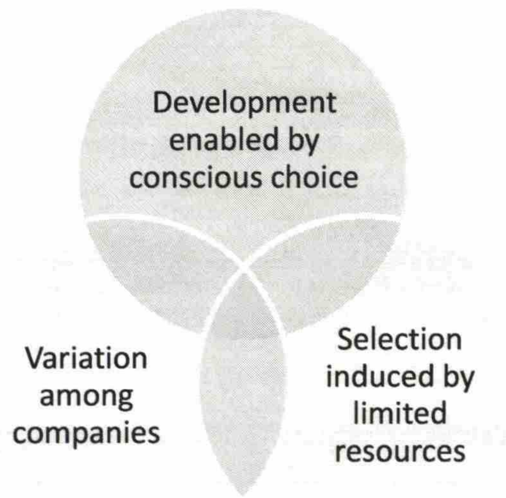

Figure 1 The interaction among development, variation and selection, adopted from Peltoniemi (2005a) and Peltoniemi (2006).

Peltoniemi and Vuori (2004) argue that complexity as a discipline has much to contribute to business ecosystem research. They introduce the following complexity aspects that they found to exist in business ecosystems. The first is *self-organisation* where the process of formation of a business ecosystem is *"voluntarily and without external or internal leader"* (Ibid., 10). They emphasises also that this creation of new connections and dissolvent of old ones is a constant process. The second concept is *emergence* which is, according to the authors, results from self-organisation, meaning that the system is more than the sum of its parts and this extra value arise from the constant interaction of these individual elements. Third concept is *co-evolution* which is defined by Merry (1999), quoted in (Peltoniemi and Vuori 2004, 11):

> *"When the change in fitness of one system changes the fitness of another system, and vice versa, the interdependency is called co-evolution. Co-evolution is the evolutionary mutual changes of species (or organizations) that interact with each other." (Merry 1999, 272)*

Moore (1993) actually defines business ecosystem as place where companies *"co-evolve around new innovation"* (Moore 1993, 75). Moore also argues that the process on co-evolving stays the same in every business (Moore 1993, 76). According to Peltoniemi (2006) this phenomenon occurs in three different forms based on categorization by Pagie (1999): *competitive co-evolution* where competitors try to gain competitive advantage in relation to each other, e.g. in price wars; *mutualistic co-evolution* where companies *"develop capabilities for cooperation and complementation in order to compete with a third party"* (Peltoniemi 2006, 12)*;* and *exploitative co-evolution* where one company is much stronger than the others and benefits from the relationship unilaterally. Peltoniemi (2005b) also defines the prerequisites for co-evolving that are:

> *"..scarcity of customers in the market that leads to selection pressure, conscious choice that enables change, interconnectedness that enables the organizations to have an effect on each other and feedback processes that carry the long term repercussions of the choices that an organization makes." (Peltoniemi 2005b, 880)*

Moore (1993) also introduces the "evolutionary stages as business ecosystem", which are birth, expansion, leadership, and renewal or alternatively death, shown more precisely on the Table 1. He emphasises that in reality these stages blur and managerial challenges of these stages intersect.

Table 1 Evolutionary stages of a business ecosystem by Moore (1993)

	Cooperative Challenges	Competitive Challenges
Birth	Work with customers and suppliers to define the new value proposition around a seed of innovation.	Protect your ideas from others who might be working toward defining similar offers. Tie up lead customers, key suppliers, and important channels.
Expansion	Bring the new offer to large market by working with suppliers and partners to scale up supply and to achieve maximum market coverage.	Defeat alternative implementations of similar ideas. Ensure that your approach is the market standard in the class through dominating key market segment.
Leadership	Provide a compelling vision for the future that encourages suppliers and customers to work together to continue improving the complete offer.	Maintain strong bargaining power in relation to other players in the ecosystem, including key customers and valued suppliers.
Self-Renewal	Work with innovators to bring new ideas to the existing ecosystem.	Maintain high barriers to entry to prevent innovators from building alternative ecosystems. Maintain high customer switching costs in order to buy time to incorporate new ideas into your own products and services.

As a synthesis of remarks from literature business ecosystem is seen as evolving and highly interconnected network of companies all which have a role to play in the ecosystem. Co-opetition and interdependence are both paramount characteristic of business ecosystem from literature perspective, and both are seen also as dominant features in the case depicted in Chapter 3.

2.2 Perspectives into Innovation Processes

There are many ways and approaches to thesis innovation in all of its phases. Gallouj and Weinstein (1997) express that the emphasis in innovation research is mainly to thesis the effects of innovation:

> *"The standard analysis of technological innovation tends to focus on the effects on innovation rather than on its actual content and characteristics." (Gallouj and Weinstein 1997, 538)*

Innovation as phenomena is a complex one, but the as Robertson (1967) describes a fundamental aspect that is essential also in this thesis:

> *"Innovation takes place via a process whereby a new thought, behaviour, or thing, which is qualitatively different from existing forms, is conceived of and brought into reality." (Ibid., 14)*

In this thesis, we are interested in the process of creating innovation in a particular sector, not to the content or characteristics of an innovation itself. The approach to and definition of products and goods will be Lancasterian (Lancaster 1966) broaden with Saviotti's and Metcalfe's (1984) view of goods as a combination of technological characteristics, service outcomes and methods of production. As explained in Chapter 1.1, the concept of innovation is defined as intentional discontinued implementation of novelty in products, goods, services and also processes. There are features in innovation that are peculiar to certain type of goods, but as a starting point or a premise is that the answers to the research questions in different type of goods convergent in such way that validity is still maintained. Research of services has revealed different perspectives to this dilemma, but as recent research shows that service development is studied i) in an assimilation approach, where services are treated similar than products; ii) in a demarcation approach, which argues that these two are completely different and product development theory is not applicable; iii) and finally in a synthesis approach, in which service research finds something universal that are neglected in traditional product development research and to which it also brings relevant new information (Drejer 2004, Toivonen 2009). Discussion and critic about this premise is presented in Chapter 5.1.

The context and form of innovation is important when considering all the characteristics of some specific innovation. The traditional research is focused mainly on new product development (abbreviation "NPD") in industrial context, but as services have grown in business meaning so has new service development (abbreviation "NSD") arisen alike. This "service-oriented" approach appeared in the late 1990's and has then on accumulated apace in research (Howells 2009, Toivonen 2009). In literature there are differences between NPD and NSD, based on the differences of services versus products (Alam and Perry 2002) – such as the latter is defined with characteristic such as intangibly, heterogeneity, perishable and inseparability (Lovelock 1983, Zeithaml, Parasuraman and Berry 1985) with more involvement with customer orientation (Kelley 1992, Sundbo 1997).

Innovations can be categorised by their effects as Freeman and Perez (1988) define them to: 1) *incremental innovations*, which occur more or less continuously in any industry; 2) *radical innovations*, which are discontinuous events unattainable through incremental adjustments to already existing regimes; 3) *new technological systems*, which are far-reaching changes in the technology affecting several branches of the economy; 4) *new Techno-economic paradigms or technological revolutions*, which are so far-reaching in their effects that they have a major influence on the behaviour of the entire economy and society.

According to one definition, innovation phases are *creation, diffusion* and *transition* (Schilling 2008). At the same time it seems that technological change is cyclical by nature. Utterback and Abernathy (1975) observed that changes go through phases of initial *fluid phase* where uncertainty prevails about the technology and its market until eventually things stabilise to specific state were *dominant design* emerges. In similar fashion, Anderson and Tushman (1990) show that after each technological discontinuity starts the *era of ferment*, where the form of technology is not yet stabilised and major design competition prevails. Eventually the dominant design emerges unless the next discontinuity has already surpassed and the previous cycle ends and substitution occurs. They also show that usually dominant design, when eventually stabilised, is not in the leading technological frontier but usually fulfils the market need by for example bundling combination of features that were not present in the initial innovation. After the selection of dominant design, comes the *era of incremental change,* where companies focus on efficiency and market penetration. This continues until the next technological discontinuity occurs and the cycle restarts.

Teece (1986) creates an extensive framework for profit distribution from technological innovations, especially how innovator should position itself against imitators/followers beforehand regarding the *appropriability regime*, *dominant design phase*, and *complementary assets* that are at function. By appropriability regime Teece refers *"to the environmental factors, excluding firm and market structure, that govern an innovator's ability to capture the profits generated by an innovator"* (Ibid., 287). These factors are legal mechanisms, such as patents, copyrights and trade secrets, and the nature of technology consisting even level of knowledge needed to create the technology. Appropriability regime can be either *tight*, where the technology is easy or even possible to protect successfully, or *weak*, where in contrast the technology is impossible to protect in any reasonable way. Teece defines the dominant design phase to be either preparadigmatic, where dominant design has not yet arisen, or paradigmatic, when "standard" has fought its way to the general acceptance. In his analysis of dominant design, Teece is not confined to a single innovation but does it in the level of paradigms and theories. Instead referring to complementary assets, Teece takes the viewpoint of an innovation and argues that successful innovation needs to be *"utilised with conjunction with other capabilities or assets"* (Ibid., 288). The dependency of innovation referring to its complementary asset defines these to be *generic*, *specialised* or *cospecialised*. When assets are generic there is no need to tailor them in any way to the innovation in question, where as specialised asset are in unilateral dependency between the innovation and the complementary asset. Cospecialised asset are when there exist a bilateral dependency. Figure 2 illustrates all possible scenarios regarding the relationship with complementary assets and innovation.

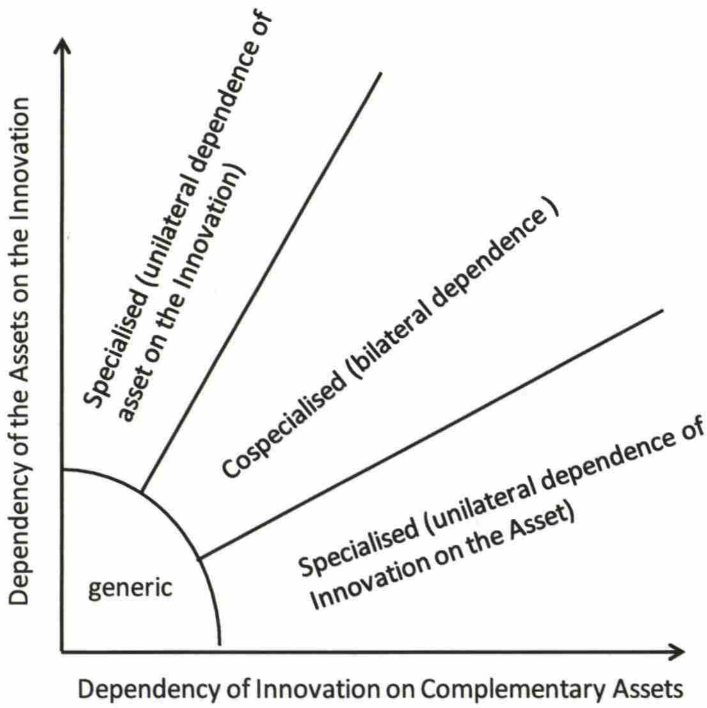

Figure 2 The different levels of complementary asset by Teece (1986).

Teece (1986) presents strategies to for the innovator in different scenarios regarding those three attributes. The main argument by him is that the ownership of complementary assets and manufacturing capabilities establishes in the long run who will benefit the most from a discontinues technological change.

Von Hippel (1976, 1988) show that depending on industry user contribution to successful innovations is high, which is against the classical view (e.g. Myers and Marquis 1969) of manufacturer is the key initiator of the innovation process. Von Hippel shows that there exist different types of innovation patterns, such as User-Dominant, in which the characteristics and process phases are different of those more traditional perspectives.

Chesbrough (2003) presents the “virtuous circle”, depicted in Figure 3. Companies invested into internal R&D which led to new discoveries, which in turn helped them to introduce new profitable products or services to market and these profits were eventually used to reinvest in more in internal R&D, which finally comes to full circle. This circle was functional only when highly capable personal were slow to move from company to company, outside sourcing for innovations were minor, and importance of external research was small. This was particularly true with established industries such as energy and transportation to mention a few.

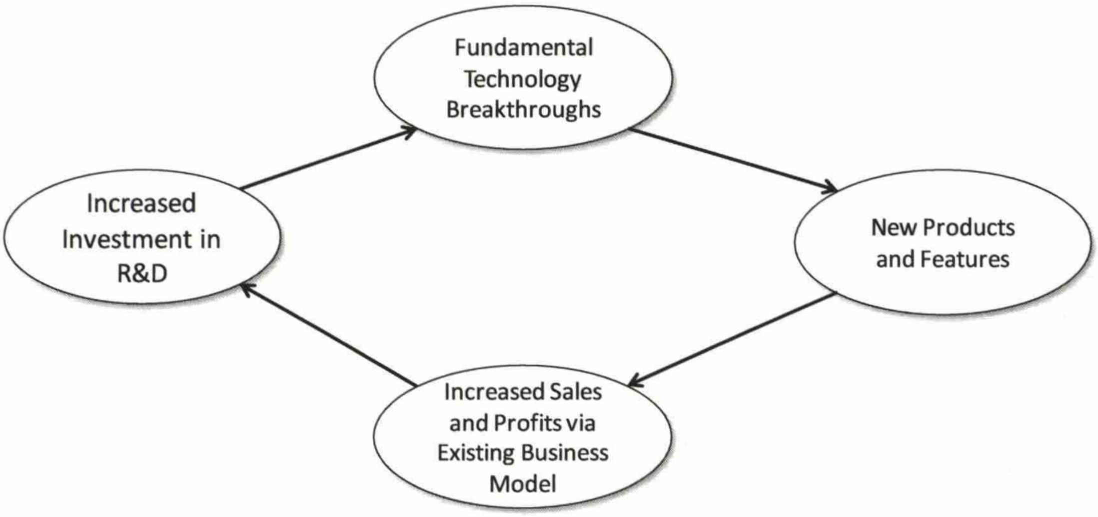

Figure 3 The Virtuous Circle by Chesbrough (2003).

One key attribute considering successful innovation is product augmentation, meaning support from suppliers to customers in which supplier *"helps customers to evaluate, buy and use of a core product"* (Johne and Storey 1998, 190). Johne and Storey (1998) emphasise the fact that these support features enhance the customer's choice between competitive offers.

Rogers (2003) presents characteristics of innovations which are presented in Table 2. He also shows that the diffusion of innovation, meaning *"the process by which an innovation is communicated through certain channels over time among the members of a social system"* (Ibid., 10), is dependent on how individuals perceive the innovation regarding those characteristic. That is, when innovations have greater relative advantage, compatibility, trialability, observatibility and less complexity to the individual then he or she is more likely to adopt it and with higher speed. Rogers (2003) also displays that in the communication channels the interpersonal channels are the most important in diffusion, especially when communicating individuals are in the same socioeconomic status, education and other factors so that they are *homophilous* in that sense. He points out that most of the time participants are on the contrary *heterophilous*, which hinders the diffusion success rate. One key finding of Rogers is that diffusion occurs in an S-curve, when plotting the cumulative numbers of adopters against time. Foster (1986) depicts similar S-curve when considering the technological improvements of an innovation. In that illustration the amounted effort against performance gained is drawn, and usually it shows slow initial improvement, then accelerated improvement and finally diminishing improvement. Both S-curves are illustrated in Figure 4.

Table 2 Characteristics of innovation according to Rogers (2003).

Characteristics	Definition
Relative advantage	the degree to which innovation is perceived as better than the idea it supersedes
Compatibility	the degree to which an innovation is perceived as consistent with the existing values, past experiences, and needs of potential adopters
Complexity	the degree to which an innovation is perceived as difficult to understand and use
Trialability	the degree to which an innovation may be experimented with on a limited basis
Observability	the degree to which the results of an innovation are visible to others

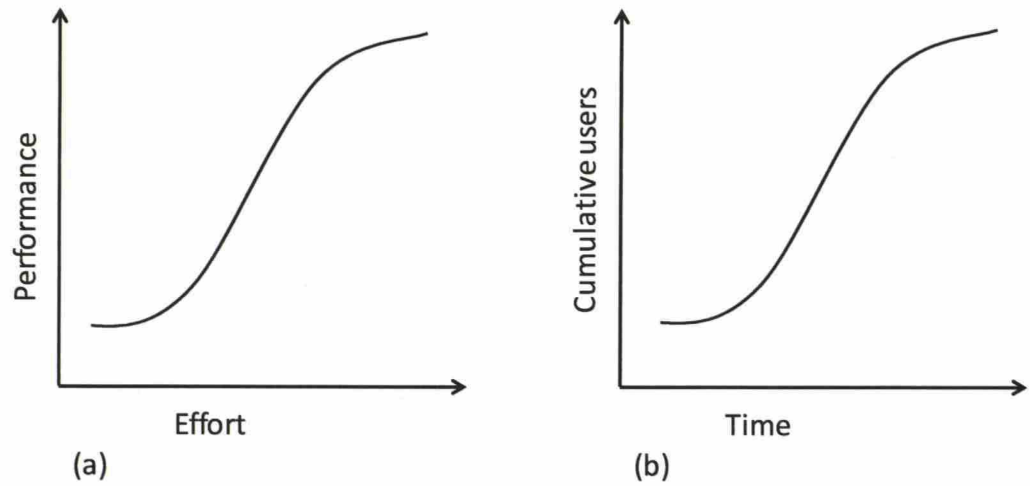

Figure 4 S-curves of (a) Technological Improvement by Foster (1986) and (b) Diffusion by Rogers (2003).

From the literature review above, it is obvious that the field of innovation research is diversified, not even considering the fact that in this Chapter only few perspectives were taken into consideration. The findings nevertheless give the basic understanding where and how to proceed on exploring answers to the research questions of this thesis.

2.3 Factors Affecting Throughput-time

Throughput-time of new product development is one metric that can be easily measured. One could argue, although based only on common sense, that there is no project of any kind in which the need to minimise the lead time from start to finish is not considered to be important. But after that the true factors that affect the cycle time is one point that literature differs and still argues, as all current active disciplines do. The viewpoints and theories are abundant (Eisenhardt and Tabrizi, Accelerating Adaptive Processes: Product Innovation in the Global Computer Industry 1995), but here some conclusions or perspectives are examined.

Gupta and Wilemon (1990) showed that importance of senior management support, multifunctional involvement, early market and technical testing, and effective project organisation are important in reducing development cycle time. Senior management helps in prioritising NDC emphasis on organisation and minimise destructive conflicts over resources. Multifunction teams integrating R&D,

marketing, engineering, and manufacturing with customers, suppliers and distributors incorporating early user involvement by testing "as-you-go" -basis gives input in forecasting the launch phase, understanding on customer requirements, sooths communication and trust among participants and enhance organisational learning to mention a few of Gupta's and Wilemon's (1990) points. Murray, Raj and Wilemon (1992) advanced this thinking and founded the following task to accelerate NPD development: 1) simplify; 2) eliminate delay; 3) eliminate steps; 4) speed up operations; 5) and perform parallel processes.

In Japan, – where in the 80's a hot research topic on process development – Imai, Nonaka, Takeuchi (1985) found that in five Japanese cases of successful new product development the most imperative feature was high supplier network involvement. This thinking was confirmed in global automotive industry by Clark, Chew and Fujimoto (1987) finding that supplier involvement, multifunctional teams and overlapping development were the key features in fast product development. These findings are out of the context scope of this thesis, but still give some perspective to those factors that influence rapid development.

Considering this base information the following chapters go deeper into specific areas of innovation processes that have influence to the speed of the process and that are considered to be relevant in this context.

2.3.1 A Systematic Innovation Process

A systematic and linear process is the most traditional way of describing the path how an innovation is evolved. In the context as firm's process the procedure of creating an innovation is divided into different stages in a linear conception. One of the most basic ones is that of research leads to development, it then leads to production and then finally to marketing (Kline and Rosenberg 1986). As an empirical study from consulting firm Booz, Allen & Hamilton shows that in the year 1968 companies' new product development process had six-stages and in 1982 it was altered to be a seven-step model, both depicted in Figure 5. The once dominant process by Meyers and Marquis (1969) is similar. It defines the innovation process also in phases, although they mentioned that process not always occur in linear fashion: Recognition; Idea Formulation; Problem Solving; Solution; Utilisation and

Diffusion (Pre-commercial); and Utilisation and Diffusion (Commercial). Rogers' (2003) classification of process with a clear stage-flow is illustrated in Figure 6. Each phase is conducted before entering the next one and no feedbacks occur between the phases.

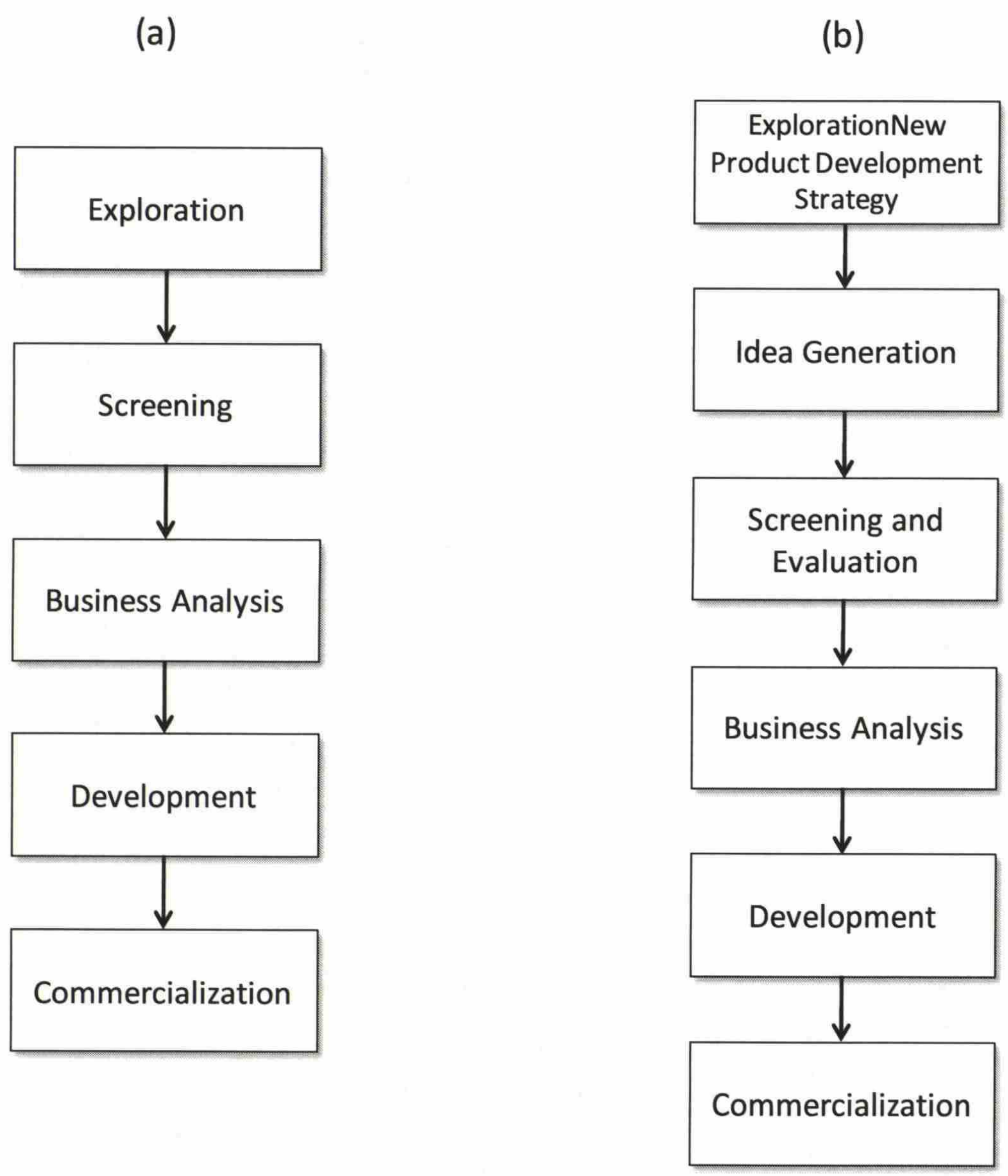

Figure 5 New Product Development Process a) 1968 and b) 1982 by Booz, Allen & Hamilton (1968, 1982).

Figure 6 Linear Innovation Model adapted from Rogers (2003).

Kline and Rosenberg (1986) represent well justified critic that in a linear process there are no feedback loops of any kind, which is a grave deficiency since *"all these forms feedback are essential to evaluation of performance, to formulation of the next steps forward, and to assessment of competitive position"* (Ibid., 286). They point out that ordinal evolutionary innovation needs iterative methods including feedbacks and trials. They proposed as a solution a chain-linked model, which incorporates also constant feedback between and among still linear stages (illustrated in Figure 7). This model is especially developed for large companies with R&D -departments, since it emphasises the connectivity of R&D personnel to the market place. As Teece (1989) points out, knowing what to develop and design is a necessary philosophy for commercial success.

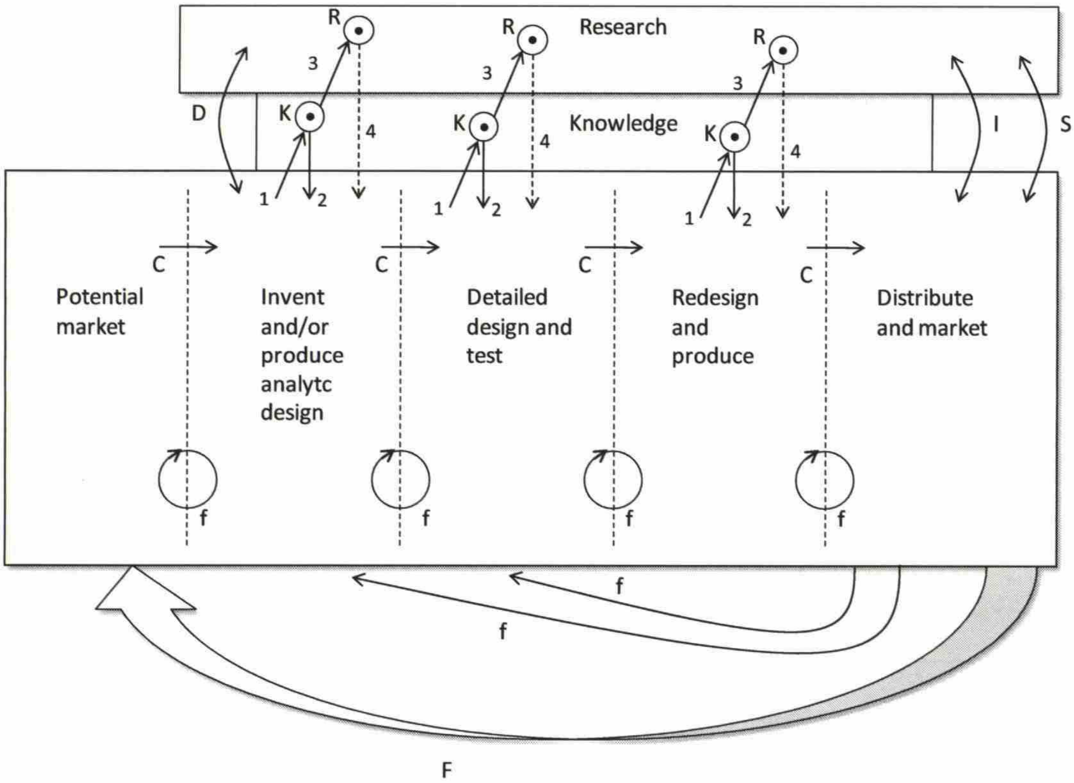

Figure 7 Chain-linked model, where flow paths of information and cooperation is shown, by Kline and Rosenberg (1986).

Symbols on arrows:
C = central-chain-of-innovation; f= feedback loops; F=particularly important feedback
K-R = Links through knowledge to research and return paths. If problem solved at node K, link 3 to R not activated. Return from research (link 4) is problematic – therefore dashed line.
D = Direct link to and from research form problems of invention and design.
I = Support of scientific research by instruments, machines, tools and procedure of technology.
S = Support of research in sciences underlying product area to gain information directly and by monitoring outside work. The information obtained may apply anywhere along the chain.

In service development a specific and alike model is created by Scheuing and Johnson (1989) in which main difference to Johne's and Storey's (1998) normal product development process was the distinction between the design of the service and the design of the delivery process. The process is illustrated in Figure 8.

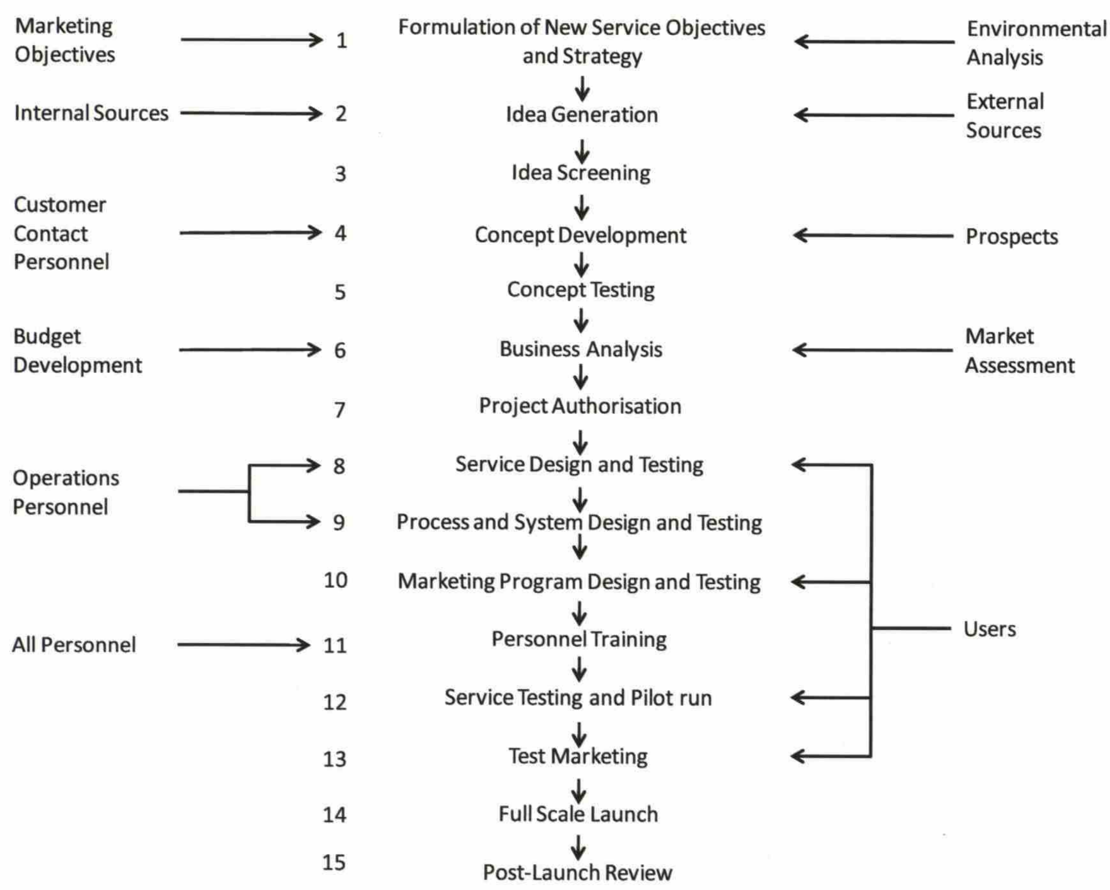

Figure 8 Normative Model of New Service Development by Scheuing and Johnson (1989).

The most pre-eminent model of systematic innovation process is that of Robert G. Cooper. It is called State-Gate process (Cooper 1990, 1993, Cooper and Kleinschmidt 1986, 1991). State-Gate process is "*a conceptual and operational road map*" (Cooper 2000, 58) that guides the innovation from idea to launch and beyond in a systematic fashion in a predetermined set of stages, depicted more clearly in Figure 9. The key feature is that before each stage there is a gate in which go/kill -decision are made by the gatekeepers to protect and demand quality and execution on an effective and efficient manner. Stages are cross-functional meaning that technical, market based, financial and operational tasks are done in each phase with some emphasis in each phase. State-gate method has evolved from the first versions of the early 90's, so that the stress on cross-functional teams and parallel activities are considered more and more.

The main function on each stage according to Cooper (2000):

Stage 1 Scoping: a quick investigation and sculpting of the project

Stage 2 Build the business case: the detailed homework and up-front investigation work leading to a business case; a defined product, a business justification and a detailed plan of action for the next stages.

Stage 3 Development: the actual design and development of the new product. Additionally, the manufacturing (or operations) process is mapped out, the marketing launch and operations plans are developed, and the test plans for the next stage are defined.

Stage 4 Testing and validation: the verification and validation of the proposed new product, its marketing and production.

Stage 5 Launch: full commercialisation of the product – the beginning of full production and commercial launch and selling. (Ibid., 58-59)

In the gates the following components are always present:

Deliverable: These are the inputs into the gate review

Criteria: These are question or metrics on which the project is judged in order to make the Go/Kill and prioritisation decision

Outputs: These are the results of the gate review – a decision (Go/Kill/Hold/Recycle). An action plan is approved, and the date and deliverables for the next gate are agreed upon. (Cooper 2000, 59)

Cooper and Edgett (1999) give rules about the Gatekeepers: they must have the *authority to approve the resources* needed for the stages; they must represent *different functional areas*; they can *change somewhat* from gate to gate; but so that *some continuity* from gate to gate is preserved. Also the process needs a process manager, who will be the "*shepherd the process*" (Ibid., 125).

The one goal that Stage-gate process drives at is reduced cycle time. By doing process with clear and discipline way helps the participants to understand what to do and when to do it. The one premise is that each stage cost more than the previous one, so the process is based "*on incremental commitments*" (Cooper 2000, 58), where expenditure increase and uncertainty decrease. Cooper (1983, 1988, 1984) has stressed in many cases the importance of predevelopment work. By itself

Stage-gate model does not use parallel processing, but inside a stage parallel processing is possible and even recommendable (Cooper and Edgett 1999). In similar fashion, it is commendable to use customers input inside stages, depending on the case in question.

Stage-Gate -process goes beyond to first static models to incorporate also *Flexibility* – stages can collapse and gates combine if necessary; *Fuzzy* (conditional) gates – gates can have more states that go/kill, e.g. conditional on occurrence of some future event; *Fluidity* – stages overlap, the demarcation of stages is more fluid; *Focus* – gate decision is coupled with portfolio management of the whole company; *Facilitation* – role of facilitator who controls that the process is done according the rules; and *Forever Green* – review and renew the stage-gate process all the time (Cooper and Edgett 1999).

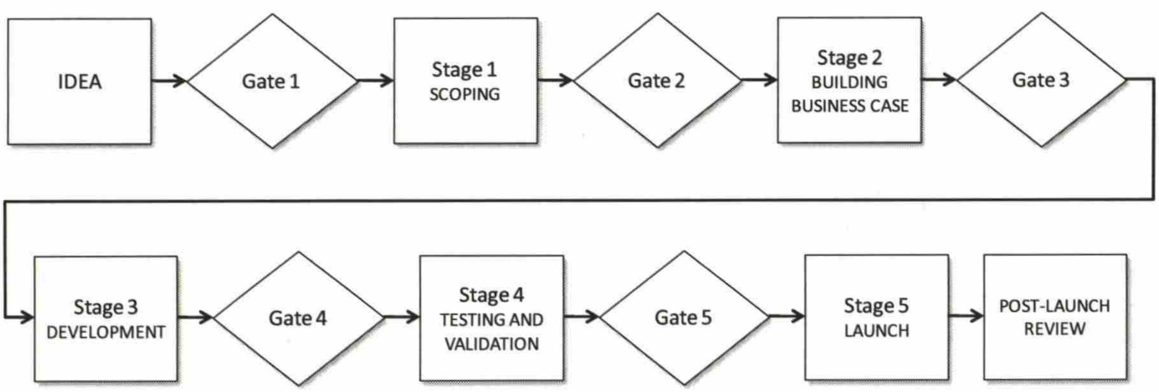

Figure 9 A Stage-Gate process adapted from Cooper (1993) and Cooper (2000).

The systematic innovation process can have influence on the time-to-market and speed of innovations. The most important reason is that innovations are run through a commonly known process so that time is not wasted on reinventing the process. Also there are many aspects of rooting out failure projects as soon as possible so that resources are given to more promising projects and their speed is enhanced. But by itself a systematic and linear process gives only a shell where more speed can be achieved by other means, introduced more clearly on the following chapters.

2.3.2 Concurrent Engineering and Parallel Activities

When considering the speed of process, an evident proposal to accelerate to process is to do things parallel instead of in a sequential manner. In the manufacturing industry this idea is not new, but eventually formulated to a doctrine in the 1980's described as "Concurrent Engineering" (e.g. Turino 1992). The process in the case portrayed in Chapter 3, this paradigm is used as background philosophy and therefore a concept of high importance in this thesis.

The basic principle of Concurrent Engineering (abbreviation "CE") is not new, as Winner (1988) describes it to be "common sense" in product development. CE in nutshell is as simultaneous or parallel engineering for reducing the time of product development (Coates, et al. 2004, Gunasekaran 1998, Ainscough and Yazdani 2000). One, and according to Coates (2004) the most cited, definition is by Winner (1988):

> *"Concurrent engineering is a systematic approach to the integrated, concurrent design of products and their related processes, including manufacturing and support. This approach is intended to cause the developer from the outset, to consider all elements of the product life cycle from conception through disposal including quality, cost, schedule and user requirements" (Winner, et al. 1988, 5)*

Cleetus (1992a) includes to the definition also response to customer expectations and team values of cooperation, trust and sharing so that decision making proceed in parallel way by all perspectives in the process. Turino's (1992) view of concurrent engineering is illustrated in Figure 10. He emphasises on the benefits of CE versus the serial design is that need of redesign is delimited, which directly influences to the cost and lead time of the project and product. This is up-front management, meaning that all aspect of product design – manufacturability, testability, serviceability – are taking into consideration and at the beginning instead of independently on each separable phase. In Turino's view this minimal need for expensive and time taking redesign to meet all the needs increases the competitiveness and thus success of the project. He still makes a notion that tradeoffs between producibility, testability, and serviceability are made in real life.

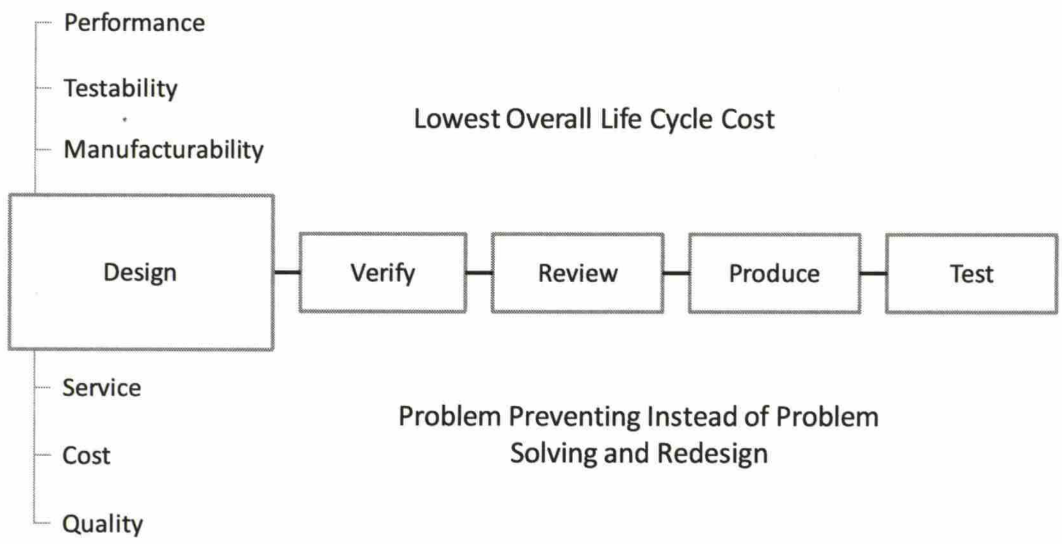

Figure 10 Concurrent engineering adapted from (Turino 1992).

Handfield (1994) studied parallel scheduling of product development activities and his empirical findings suggest *"that concurrent engineering may be appropriate for incremental innovation, but may have some "hidden costs" in the form of increased defects when applied to new "breakthrough" innovations"* (Ibid., 384). Also according to Krishnan, Eppinger and Whitney (1997) parallel activities may present grave difficulties and result to increased cost and poor quality when the communication between the processes are insufficient. Their main argument is that in developing products of technically complex interconnected features the process of this development imposes certain precedence relations among activities, which thus leads to the conclusion that all activities cannot be conducted in completely concurrently without high risk of failure. They presented a derived framework of overlapping activities, which is derived by transforming sequential process model to parallel integrated linking and coupling. This path is depicted in Figure 11, where it can seen that total lead time (t_{total}) is less in overlapped process than sequential process, because cooperation and collaboration between activities A and B are started before Activity A is finalised.

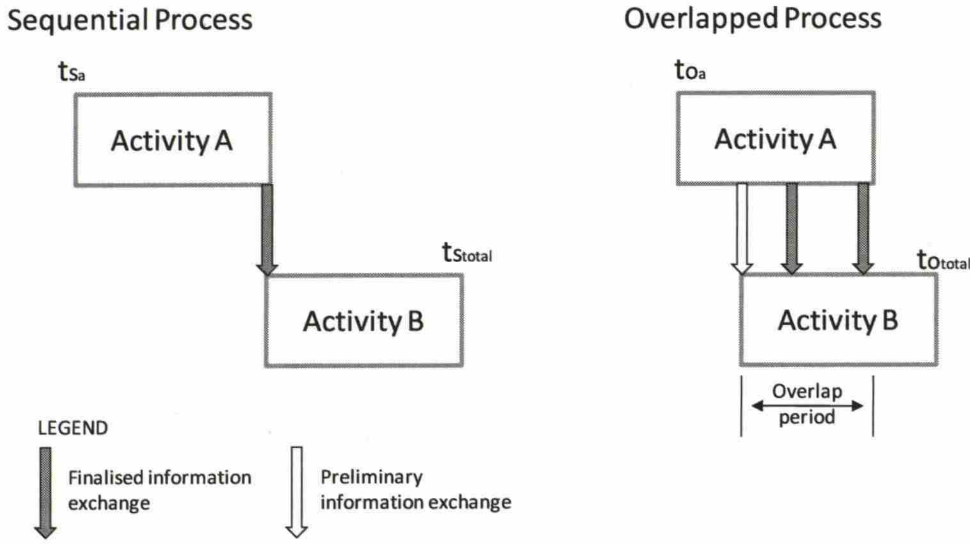

Figure 11 Overlapped Process and Sequential Process adapted from Krishnan, Eppinger and Whitney (1997).

Haque (2003) highlighted the need for cross-functional involvement, both horizontally and vertically across each activity to tackle the main problem of loose integration between different development activities. Also the organisational aspect in leadership and communication channels combined with training to create awareness of the process should be considered all the way the value chain (including e.g. sub-contractors). Cleetus (1992b) also emphasises that right decision making needs a collective intelligence from all roles of development *"so that the judgement of several minds is brought to bear on every issue"* (Ibid., 3). Turino (1992) draws attention to that in CE process the company should always use multifunctional and multidisciplinary teams. He sees that all members are responsible for timely and cost-effective delivery of the project. Management's role is more to provide *"right resources with the right information at the right time"* (Ibid., 5).

Also in more general view Alam and Perry (2002) reveal that in new service development in larger firms sequential process is more common when as in smaller firms parallel model is more popular. They illustrate two process options for creating new services, in which the first is a traditional sequential model and the second is a semi-parallel model, where some stages are combined to be implemented in a parallel fashion (see Figure 12). They propose that this parallel model is to be used if there is a need to develop new services quickly, which in most industries is the key success factor of that innovation.

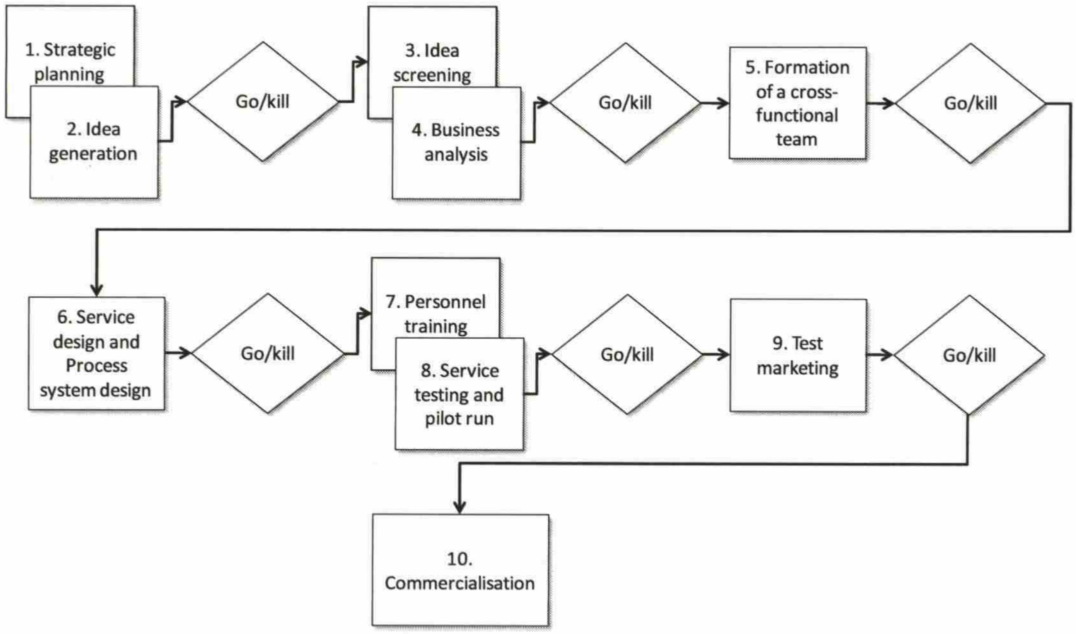

Figure 12 Parallel process model for new service development by Alam and Perry (2002).

In summary, concurrent method comparing to sequential process by itself has many benefits, especially considering the speed of the process. Although there are many implications also that causality within different phases requires at least some sort of sequential process, particularly for the sake of process measurability to be manageable. Literature above suggests that semi-concurrent models with traditional go-kill -gates exists and are usable in context of this thesis.

2.3.3 The Accelerated Application Process

As short product life cycles and brief windows of opportunity are more and more common to ICT-sector when the business environment comes even more turbulent, the need for adaptive process grows even more (Kreiner 1995). Sequential models are designed to operate in mature environment were the future could be at least to some precision predicted and planned so that cohesive actions are possible to coordinate (MacCormack, Verganti and Iansiti 2001). Bureaucratic and rigid formations give by systematic and rational way the necessary push to accelerate innovations (Brown and Eisenhardt 1995). But in a complex and fast moving world they only lead to oppressed creativity, add unnecessary bureaucracy and too long time-to-market (Iansiti and MacCormack 1997, Engwall, et al. 2001). To this dilemma alternative method of process coordination are based mainly to the philosophy of fast adaption and incremental and constant prototyping. Change is not resisted but embraced by these new models (Iansiti and MacCormack 1997). The basic idea is that activities go forward in an iterative method, where feedback received from cycle is used to guide the next cycle's activities (Eisenhardt and Tabrizi 1995, MacCormack, Verganti and Iansiti 2001).

In flexible process, according to MacCormack, Verganti and Iansiti (2001), *"should focus, above all, on getting an early (and by definition, incomplete) version of the product into customers' hands at the first opportunity"* (Ibid., 144). Engwall et al. (2001) present few alternatives to the traditional, but quite out-of-date, stage-gate model that are used in the telecom industry (see more sophisticated state-gate process in Chapter 2.3.1). The first is so called "Rapid Application Development" that has roots in software development, where this early-to-customers philosophy is used – Figure 13 illustrates. The result was that useable product was gained at 10 times faster than in the traditional method, although the final product with all of its support activities (manuals, customer care etc.) was achieved at the same time. Anyhow the appearance to the market was still substantially swifter. Engwall et al. (2001) impress also the users input, by fast prototyping, demanding lead users involvement and pilot customers, so that project content is meaningful and based on real customer needs and input in the early phases.

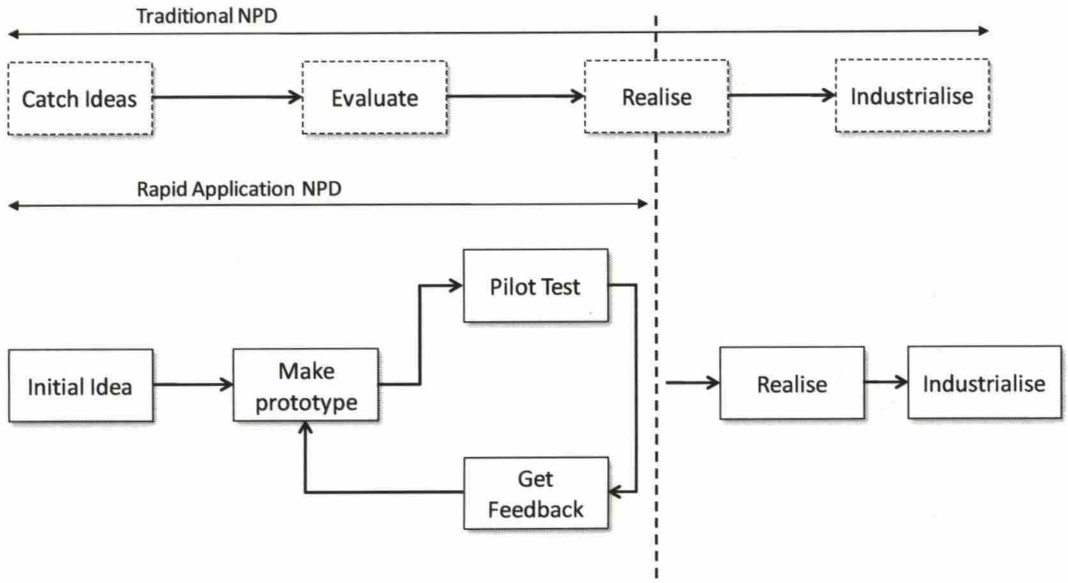

Figure 13 Difference between traditional process and rapid application process by Engwall et al. (2001).

Eisenhardt and Tabrizi (1995) showed that strong empirical link exist between rapid product development and multifunctional teams accompanied with combinational and experimental strategy of iterations, testing, milestone, and powerful leaders. They argue that *"fast product development emerges as more uncertain than predictable, more experiential than planned, and more iterative than linear"* (Ibid., 104).

Moorman and Miner (1998) studied the phenomena of improvisation on organisations to create innovations. In well established paradigm is that company's strategy should be done before executing innovation development. They found that improvisation occurs moderately in organisations, and that organisational memory decreases and outside turbulence increases the level of improvisation. In some cases they argued that it can be beneficial depending on the context in question, although more generally it is noticed that improvisation can reduce new product effectiveness. According to Eisenhardt and Tabrizi (1995), the basic idea behind Moorman's and Miner's concept is that new innovations are hard to create in an obscure and unpredictable environment which means that acceleration of innovations requires intuition and flexible options – it is a *"response to uncertainty than certainty, more iterative than linear, and more experienced-based than planned"* (Ibid., 88).

2.4 Factors of Success in Innovation

The success factors affecting innovation have been widely studied, although the results are not conclusive. There are many standpoints that give good input to the research question of this thesis. But before that, the definition of success must be presented in the context of this thesis. As it was declared in Chapter 1.2, this work uses general factors that are according to Shilling (2008) 1) *maximising fit to customer needs*; 2) *minimising the development cycle time*; 3) and *controlling development cost*. Brown and Eisenhardt (1995) found similar factors, dividing them to *Process Performance* (most important the speed), *Product Concept Effectiveness* (fit to market needs and firm competences), and finally *Financial Performance* with in a way is corollary from these two combined with the *Market* (growth and size). But in articles referred here the standing point is not always brought out in the open

– from the context of those articles it is assumed to be general as for example "profit to the innovator" or "market share of the new product or service". Those goals can be assumed to have a correlation or even causality to the goals defined in this work, so worth findings of those articles are valid also in this thesis.

De Brentani (2001) reports that the following factors affects the success of new service ventures: 1) *ensuring an excellent customer/need fit*; 2) *involving expert from line personnel in creating the new service and in helping customers appreciate its distinctiveness and benefit*; 3) *and implementing a formal and planned launch program for the new service offering*. She also points out that type of innovation, defined by the newness of it to customers, has implications to other factors regarding the success of innovation. If innovation is with "high newness", then the most important is "*corporate culture of the firm*, which *encourages entrepreneurship and creativity, and that actively involves senior managers in the role of visionary and mentor for new service development*" (Ibid., 169). When the innovation is more or less incremental, that is when newness is "low", then de Brentani's findings suggest that by 1) *leveraging the firm's unique competences, experiences and reputation;* 2) *installing a formal "stage-gate" new service development system;* 3) *and ensuring that efforts to differentiate services from competitive or past offering do not lead to high cost of unnecessarily complex service offering.* Cooper and Kleinschmidt (1995) points out similar factors from empirical data, but also includes factors such as *adequate recourses for development, senior management commitment and accountability*, and *high quality development teams with cross-functional personnel*.

The "Fuzz front-end" (abbreviation "FFE") is defined by Kim and Wilemon (2002a) *"the period between when an opportunity is first considered and when an idea is judged ready for development"* (Ibid., 269). Cooper (1988) identified so called predevelopment stages, which are *idea generation*, *product definition*, and finally *project evaluation*. His findings suggest that through preparation and screening using these three stages the innovation is more likely to succeed in development and marketing phases later on. This was confirmed by Murphy and Kumar's (1997) empirical study, in which suggestion of user involvement on the first stage was identified and that firm's strategy and operational capabilities should be linked in product definition phase to gain organisational support for the endeavour. Cooper and Kleinschmidt (1986) show that by investing more resources and emphasis on FFE correlates to successful new product developments. Cooper (1993, 1995) also shows that predevelopment work pays itself in reduced throughput-time and better success rate.

Considering these findings and keeping in mind the scope of this thesis, the focus in the following chapters is concerned with how to involve customer effectively in the innovation process and what benefits does a new network oriented paradigm of open systems give when creating innovations.

2.4.1 User Centric View

In order to maximise the success or to minimise risk of failure of a new innovation, one essential factor is that how well the innovation delivers superior value to and meets the needs of customers. To cope with this challenge one method is to be *market-oriented*, meaning that when customer needs and expectations evolve over time, the deliverer is consistently on-track by monitoring current and future customer needs, information gathered is disseminated across the company and organisational responsiveness to these changes is handled well (Kohli and Jaworski 1990). Narver and Slater (1990) show that there is an empirical relation between market orientation and business performance, which result Jaworski and Kohli (1993) expands to be robust across environmental contexts'.

Lüthe and Herstatt (2004) argue that user involvement is dependent on the type of innovations, that is in similar fashion than de Brentani's findings. They see that the most beneficial interaction from the end-users is in the "fuzzy front-end" phase for the role of an information source, this way market uncertainty is reduced on the early stages of the process. They see it important, because – as Kim and Wilemon (2002b) show – it is the product idea that eventually define the product concept and determine the main features or attributes of the final product. Lüthe and Herstatt (2004) show that for incremental innovations the widely used market-research method can be effective, but for radical, breakthrough innovations conventional market research methods do not work, because a) they operate with random samples of customers and b) the techniques used do not reveal new product ideas beyond well known area. Von Hippel (1988) argues that conventional methods do not bring out emerging needs or to identify new solutions for those needs. Still empirical studies show that users contributes in many ways to new innovations, even in the idea generation phase (e.g. Morrison, Roberts and von Hippel 2000, Urban and von Hippel 1988). Research by von Hippel (1976, 1988) found that innovative users are the progressive part of the user base, to which he named "Lead users". This group has the following characteristic according Lüthe and Herstatt (2004):

> *"Lead Users face new needs of the market and do so significantly earlier than the majority of the customers in market segment (capability).*
>
> *Lead Users profit strongly from innovations that provide a solution to those needs (motivation)." (idid, 556)*

Lüthe and Herstatt (2004) also describe the process of Lead user method, which is illustrated in Figure 14. The main argument based on theoretical background and empirical data is that the lead user approach affects the newness of the innovation, the expected turnover, the market share, and the strategic importance of it – thus the approach has many interesting aspects to consider when evaluating success factors.

Gruner and Homburg (2000) show that customer interaction in the innovation process has a positive impact on the success of the product. The research was based on the basic process of six-stage model (consisting *idea generation*, *product concept development*, *project definition*, *engineering*, *prototype testing*, and *market launch*). The results indicate that customer interaction is most useful in the early or late stages of the process, not so much in the medium stages (project definition, engineering). They also point out that being connected to lead users or financially attractive customers is promising, but on the other hand technically attractive customers do not enhance the prospect of product success.

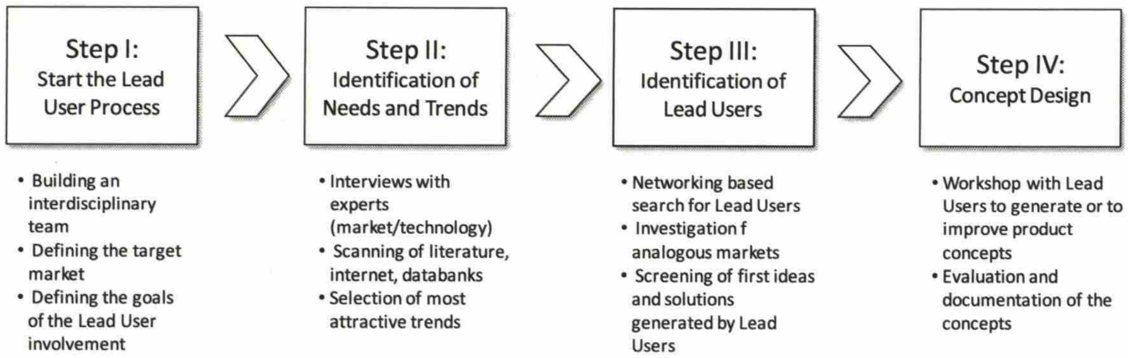

Figure 14 The Lead User Method by Lüthe and Herstatt (2004).

Alam and Perry (2002) argue that in new service development customer input is essential and necessary element when creating superior services with better value for customers. They also show that customer input can help reduce development time, when customer involvement is done proactively in the early stages of the process. Their findings suggest that customer input is needed in every stage so that developed services match customers' needs – that is that companies adopt a customer-oriented approach. Alam and Perry emphasises that companies should develop *"long-term relationship with customers and treat them as partners in their quest for successful new services"* (Ibid., 528). Their suggestion of customers' input in each development phase (based on the process illustrated in Figure 12) is shown in Figure 15.

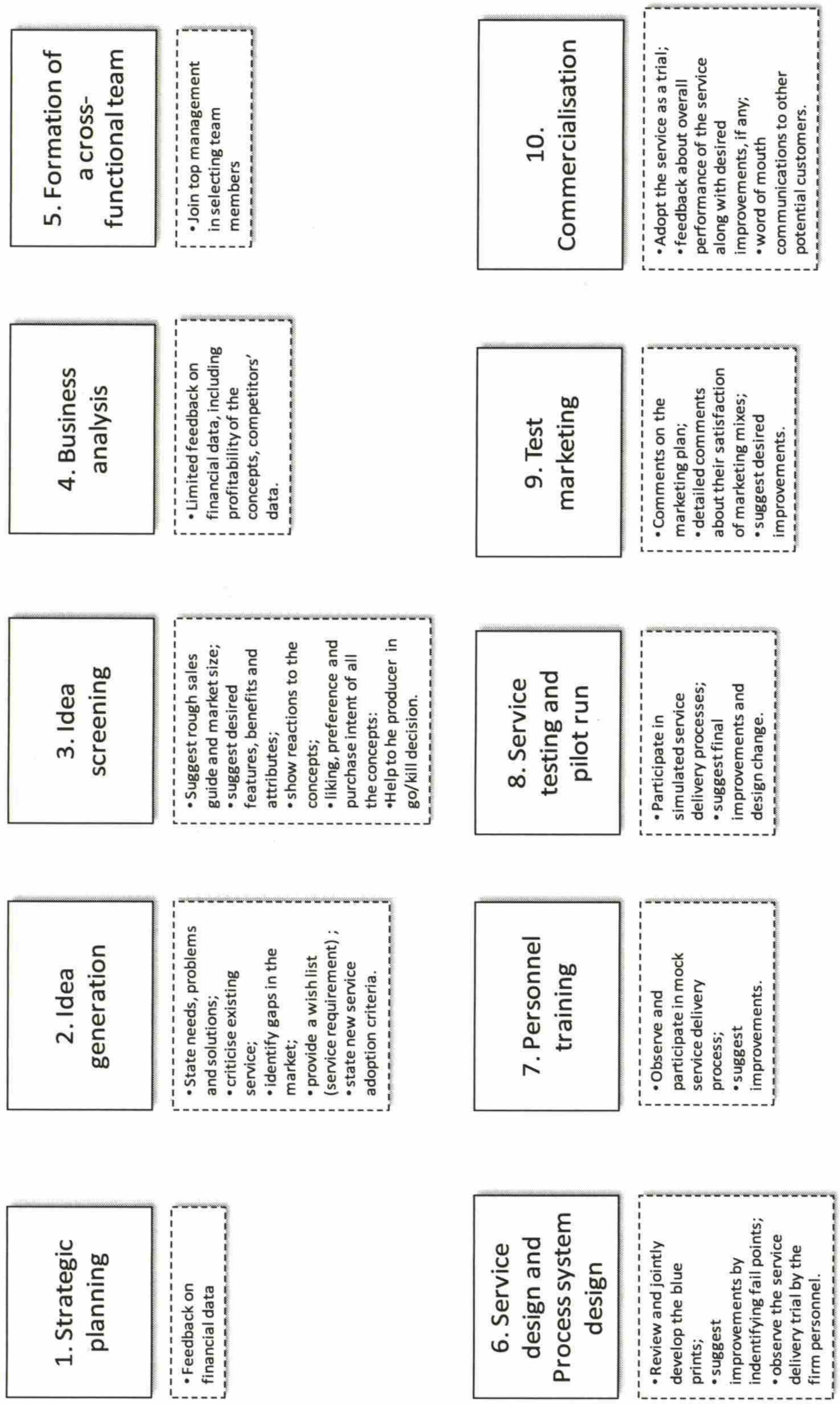

Figure 15 Customer's input in new service development process adopted from Alam and Perry (2002).

2.4.2 Open Innovation

In the context of interconnectedness and business networks, the paradigm has altered from do-it-your-self to more co-operation and network development (Schilling 2008).

Chesbrough (2003) illustrated how the breakup of the virtuous circle occurred, due to certain erosion factors that emerged from 1) high mobility of talented personal; 2) outside funding for start-ups (e.g. VC); 3) when universities were more important in applied research so that information and knowledge were not any more in silos or monopolised by some; 4) market entry was lower; 5) fast cycle time of many products and services which contributed to possibility to create added value fast from new ideas. Also the linkage between research and development loosened. This change is depicted in Figure 16. This led to a new paradigm, called Open Innovation. The environment went from closed to open, were new ideas can be accessed from outside as well as from within. Companies had to cope with the idea that things were not always invented in-house and could still be used effectively and successfully (Chesbrough 2003).

Market experimentation is important, because history has proved in many instances that the best use of product or service is far from the initial use planned. Chesbrough (2003) gives these advices for managers to *"seek to explore a variety of possibilities which you should seek rapid feedback at as low a cost as possible; do tests that are highly faithful to the eventual market; instead of detailed planning you should do some initial probes and then react quickly to the new information"* (Ibid., 13).

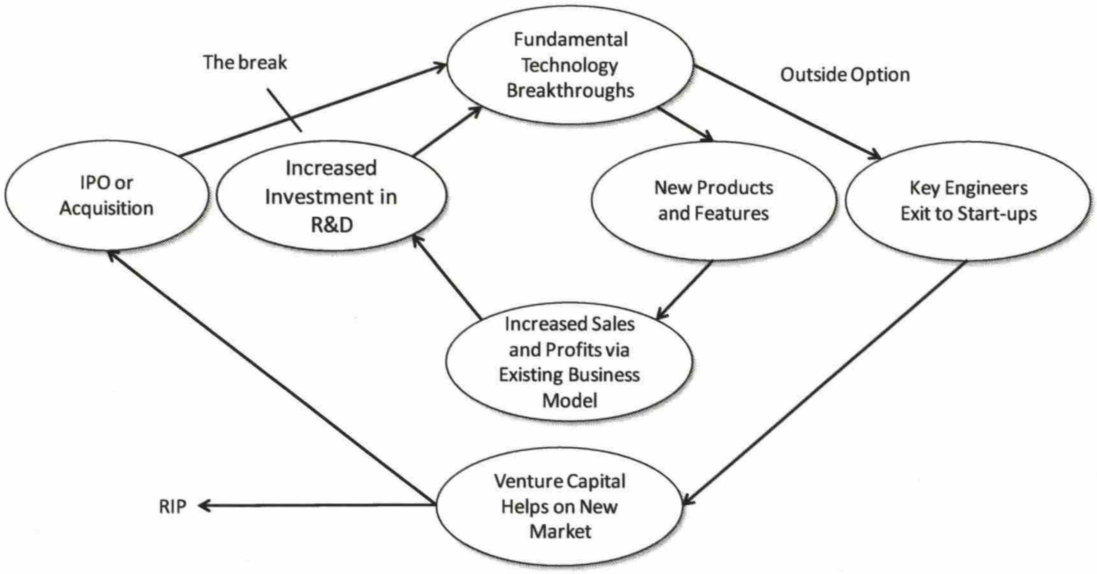

Figure 16 The Virtuous Circle Broken by Chesbrough (2003).

Chesbrough (2003) developed a new rationale for internal R&D, emphasising on the balance between own and outside research:

> *To identify, understand, select from and connect to the wealth of available external knowledge.*
>
> *To fill in the missing pieces of knowledge not being externally developed.*
>
> *To integrate internal and external knowledge to form more complex combinations of knowledge, to create new systems and architectures.*
>
> *To generate additional revenues and profits from selling research outputs to other firms for use in their own systems. (Ibid., 53)*

One key point is that a technology company should do fast development since technology can be rapidly diffused and copied. Chesbrough (2003) sees that usually companies operate in false premise that if you do not make your products obsolete, no one else will either – which is not the case.

To actively use outside resources by venture capital is according to Chesbrough (2003) one successful way to create innovations. His view is that start-ups are "pilot fish" that tell about the real market and drives for potential new market opportunities. They provide a good outside path for technologies that otherwise would not be created. It forces research to go faster outside the laboratory, because there is a real incentive to create new added value innovations.

By open systems companies can enhance the diffusion of the created technology and create the self-reinforcing feedback effect that leads to dominant design. On the other hand, this can lead to loss of control on the technology development and fragmentation of platforms (Schilling 2008).

As a synthesis, in a more and more interconnected network of companies, fierce competition and fast cycle time, a whole proprietary starting point may not be the successful approach. Instead, open system thinking can achieve more successful results when companied with coordinated in-house R&D and active venturing.

3 Target and Conduct of the Case study

3.1 General Description and the Goal of the Case

This case is a pilot project run by the participants and Tivit Ltd, the process facilitator and creator. It was chosen to be used as empirical data in this thesis, because the innovation process in the project was managed by systematic framework which main function was to accelerate throughput-time and create successful innovations in a business network context. The framework has a clear connection to the presented literature (the connection is analysed in more detail in Chapter 3.2.4) and thus provides insight and relevant data for this thesis.

The project is described as "National Project" according the Project Plan. It is focused completely in Finland, although most of the participating companies are international by nature. In a nutshell, the main idea is to develop a new business for the participants in ICT-sector. The case project has interconnectedness to Tivit's Strategic Reseach Agendas (SRAs) and thus was the first to run the new Tivit's (Concurrent) Ecosystem Creation Process. The case project was ongoing during most of the interviews and cannot fully be evaluated ex post. But it still has quite distinct phases to be analysed and used for empirical data in this thesis.

The main participant companies are described in Table 3. The participators create a network, which can be categorised to be a "value network" as defined in Chapter 2.1 since not a single company has dominant role in the network. Main participants companies have done common development and collaboration for many years and so worth this network model is no new thing.

Table 3 Participating companies.

Company	Groups indentified[1]	Prime function and key features
TIVIT	Process Facilitator, Interest Group	Creator of the process which was piloted in the innovation generation phase. Organised many functions as project coordinator and facilitator including third party finance, but not a major actor in the final business ecosystem to come (in one work package is dedicated to be handle certain functions for some specific and limited time).
COMPANY A	Technology Providers	Main participant of the process and also in the future ecosystem.
COMPANY B	Technology Providers	Main participant of the process and also in the future ecosystem.
COMPANY C	Complementary Product/Technology Producer	Market leader in manufacturing products that are used as core instruments for technology transmission and functionality of the proposed business model. In this development process creates a new service where the technology created by Companies A and B is applied.

From Cooper's evolutionary phases of business ecosystem, this particular one considering the group "Technology Providers" is in phase *Self-Renewal* (see Table 1). The main participants, Company A and B, are both been at the industry for a long time as competitors and are dominant market share holders. Their ambition is to create new innovations to a market that is almost saturated with very high level of

[1] Identification is done by the author based on interviews

penetration of current base technology and fierce cost competition. Innovation in this case is a business model innovation, not as much as technology innovation. The core technology, including end-user services, has been developed by the current case actors themselves independently. However, the results were not good – the reasons for failure were mainly that enough customer base was not gathered for dominant design to emerge. Thus, the base technology allows the business model innovation but there are many other aspects that have to be formulated during the innovation process to make the service provided to the customers operational.

One key point is that Company D is needed in the new business ecosystem for it to work, because the basic idea is wide interoperability and end-user coverage – lesson learned from the individual, unsuccessful trials by the companies themselves. Company D is not involved in development phase but remains as informative partner in the Interest Group. With company D, the cover will be approximately 98% of the potential end-user base – other technology providers are thus considered to be irrelevant at the beginning.

Service Providers are important because the benefit that End-users receive is through services that use this technology provided by Technology Providers, not from the technology itself. In the services the technology is considered as one alternative way to handle the function needed, there are and in future will be other competitive ways as well.

Interest group consists of a large number player in the field, mainly associations, government agencies and similar organisations that are considered and recognised as relevant in the development and in the final ecosystem. One important factor is that legislation has just given the necessary basis for the use of technology and is considered essential factor regarding the basic feasibility of the business model. The final ecosystem with all its actors and the current participants of the development project is illustrated in Figure 17.

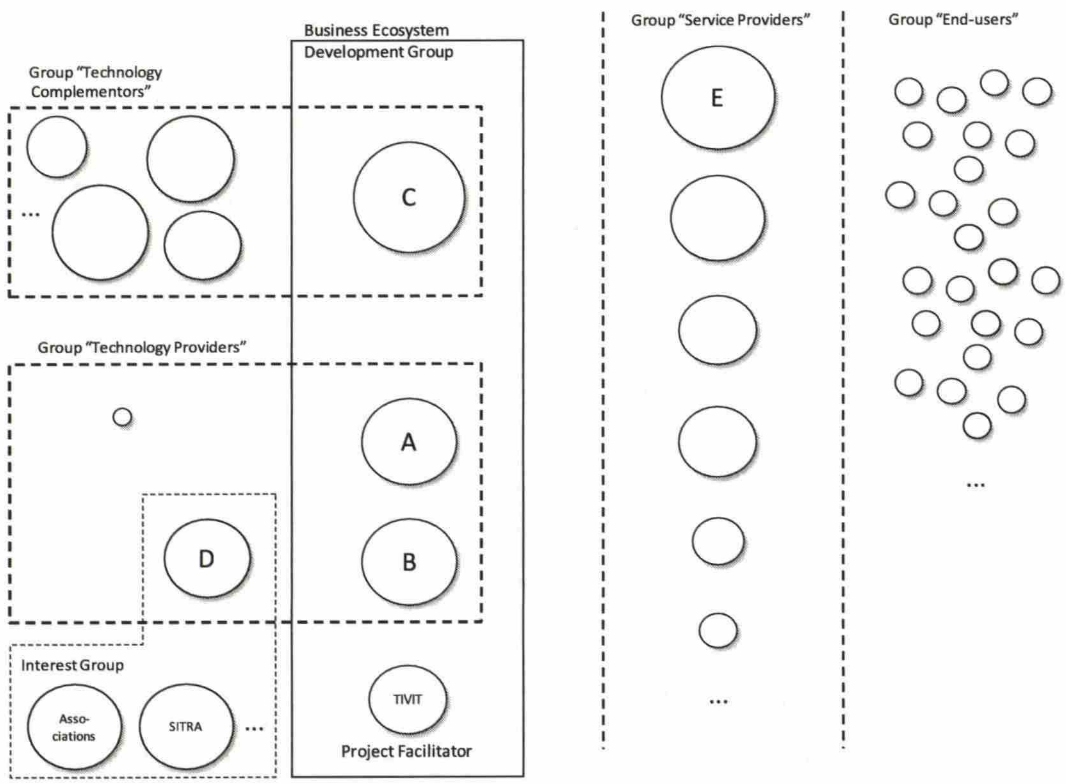

Figure 17 Participants in the future ecosystem (all excluding TIVIT and some of the Interest group members: associations and such) and current development process (only A, B and C with TIVIT). Actor E is recognised as a critical service provider considering the success rate of this innovation, especially at the beginning.

Also during the process, new and radical innovations are under development (direct new services for users are done in two work packages) and there are great expectations that other actors (mainly Service Providers) create these more when the "technology platform" is published.

The development project was divided into five specific work packages where services for users and to the Service Providers are developed. One of them is managed by Company C, all others by Companies A and B, and in one Tivit Ltd has a larger role than just project process facilitator. The one where Company C is active is more applied development for a real service for end-users, where as the other packages are more on the base technology side including creation of agreements and similar functions. A summary of the work packages is presented in Table 4.

Table 4 The work Packages of the case-project.

Work Package	Short description	Main contributor
WP1	Guidelines and agreements, proof-of-concept by Companies A and B.	Companies A and B
WP2	Creation of interface for Service Providers to implement the technology to their services.	Companies A and B
WP3	Creation of complementary and concrete new services for users utilising the core technology.	Companies A and B
WP4	Applied development of complementary use of the core technology.	Company C
WP5	Preliminary research on wider use of the core technology as a architecture and agreement platform.	Companies A, B and TIVIT

3.2 TIVIT Concurrent Ecosystem Creation Process

In this case, the TIVIT (Concurrent)[2] Ecosystem Creation Process is used as a framework and a project management guideline for coordinating and management of development work. In case analysis, the process and its implications regarding the research questions are considered to be paramount.

[2] The term "concurrent" was introduced during the case research and was not widely known by all the participants interviewed.

3.2.1 History and Objective of the Process

Tieto- ja viestintäteollisuuden tutkimus TIVIT Oy/Ltd is one of the SHOK -programme companies, focusing on the ICT-sector. Tivit's mission is to create *"new ICT based business ecosystems to enable new global growth business for Tivit's owners and partners"* (Paajanen 2009, 3). Its task is to coordinate and run active research programmes with universities and companies. These programmes are called Strategic Research Agendas (SRA), and at the first phase there are four of them altogether. Each SRA drives for new breakthroughs and creation of new business ecosystems. SRAs consist of multiple projects and have a life-span of 3-5 years on average.

One key concept of Tivit is to shorten the throughput time from research to real business. As a model to help this goal, it uses an "(Concurrent) Ecosystem Creation Process". This is expressed as follows:

> *"The purpose is to accelerate the flow of results from research to business utilization, to create business breakthroughs and knowhow for commercially applicable business development" (Tivit Ltd.).*

This process was created by TIVIT's CEO Reijo Paajanen based on his previous experiences in the ICT-industry, especially in Nokia's research and development at the 1990's. The process model is under constant development when results and feedback from pilot projects are received.

3.2.2 General Description

The process is directed to innovation work in networks, not within a single company, but the main idea is supposed to be the same as in creating new products.

The principles of the process are the following ones from Paajanen (2009):

- It is important to find a meaningful business opportunity, where business motivations can be focused on the same breakthrough.
- All the required elements to the ecosystem are developed in parallel in each phase, not in sequence to minimise throughput time and overlapping work.

- Phases follow each other and each phase ends to a milestone, a Go/No-Go decision made by Ecosystem Program Steering Group.
- Within phases a Scrum -like methodology is used as applicable.

The benefits are outlined as the following, from Paajanen (2009):

- It improves communication among participants and ensures that activities are aligned towards a common goal.
- It enables a smooth, time and cost efficient building of ecosystems starting from ideas, technologies and market potential and aiming to their effective implementation in participating companies' applications.
- Phases and milestones form a basis for procedures, routines, checklists, etc., – tools to make the project work smooth. Concurrent creation approach links participating companies together.

The process is divided into six different phases and milestones and they are illustrated and stipulated in Figure 18.

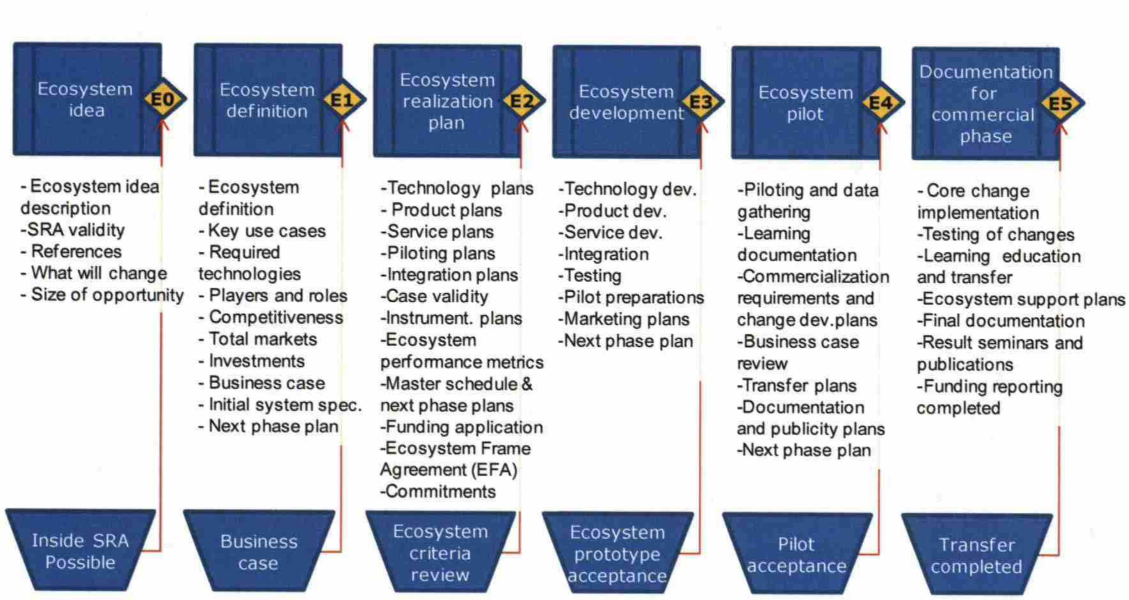

Figure 18 Ecosystem Creation Process stages and gates according to Paajanen (2009). ©TIVIT Ltd.

In Tivit projects, it is common that TEKES funding is somehow connect to the process, because projects run by Tivit are always connected to its SRA's and thus relevant to TEKES funding.

The organisation for a project normally consists of a Steering Group, where the chairman is Tivit CEO; Interest Group; Ecosystem Program Manager (EPM) from one of the participating companies or from outside; and specific Work Groups. The milestones are accepted in Steering Group meetings. In phase E2, the Tivit Ecosystem Frame Agreement (EFA) is done, which for example defines business model division and Intellectual property rights (IPR) questions and gives backbone to the implementation.

The following rules are defined (Paajanen 2009):

- The Ecosystem Program is managed in practice by Ecosystem Program Manager (EPM).
- The project team members from participating organizations have the full authority to represent their organization in Ecosystem Program.
- Participating organizations are responsible for allocating sufficient amount of capable resources for Ecosystem Program's use.
- Ecosystem Program Manager (EPM) has the full authority to run the Program from Milestone E1 to Milestone E5.

A normal throughput time is estimated to be approximately one year, but because there are no projects that have gone through it yet, it is not based on experience. Albeit this process is created or adapted to Tivit's SRA-based projects, it can be utilised by other parties as well. Tivit's role is just to facilitate projects that derive from its SRAs and to promote these projects to emerge in the first place.

3.2.3 Phases of the Process in Detail

Each phase consists of a thematic function, a task to be done and finally a milestone analysis where the decision about the continuation or termination is done by the acceptance body. The decision is based on the results achieved in the phase. In each milestone, the acceptance body, meeting agenda, requirements for acceptance and motion of positive outcome are defined (Paajanen 2009). The phases and milestones are described in more detail on the following subchapters based on Paajanen's (2009) presentation.

3.2.3.1 Ecosystem Idea Phase and E0 Milestone

In the first phase, the idea of the innovation and the business ecosystem is described. Also the compliance to Tivit's SRA is done by matching it to the goals of the ecosystem and to the competence level of the participants. Analysis is concentrated on current solutions or substitutions and on the size and opportunity that could be gained, for instance initial information about how large the market is, how well can this project build momentum and what is the timing. The key question is of course what will change due to this innovation.

Acceptance body is either already operational steering group or if it is not yet formed, then a relevant interest group that has the power to continue the process into the next level. The requirements for acceptance are: idea makes sense; SRA match; a momentum building opportunity; size of the opportunity; and commitments to the next phase. As a positive outcome it is defined that opportunity in question exists within SRA.

3.2.3.2 Ecosystem Definition Phase and E1 Milestone

The second phase is more detailed analysis of the ecosystem. It includes key pilot use cases, analysis of required technologies and definition of players and their roles. Also strategic analysis is done on competitiveness using, e.g. Porter matrix, on total markets in more detail, and on investment needs for pilots and for commercial phase. The business case is formulated and initial system specification is formulated for the realisation phase.

Acceptance body is from this phase on the Steering Group. The requirements for acceptance are: SRA match; ecosystem is *"relevant and helps to gain technology or business leadership"* (ibid., 16); business case makes sense; players and their roles are agreed on; commitments to the next phase are in place; and the next phase plan is ready. As a positive outcome of this milestone the ecosystem and business case are defined.

3.2.3.3 Ecosystem Realisation Plan Phase and E2 Milestone

The third phase is about planning. Plans for technology, products, services, integration, piloting and instrumentation are developed. Also the case validity is checked and performance metrics for the ecosystem are generated. Master schedule is forged and funding application is initiated. As an important task also the Ecosystem Frame Agreement (EFA) is agreed upon and necessary commitments are gathered as in the previous phases.

In the milestone the steering group accepts the continuation based on whether design rules are agreed; specifications including initial platforms can be frozen; schedule for the open items is done; liability issues are taken into account; third party patents are checked; funding application is ready; as well as the EFA and next phase plan are completed and milestone E3 expectations are defined. As a positive outcome the commitment to the project is achieved.

3.2.3.4 Ecosystem Development Phase and E3 Milestone

Ecosystem development is the fourth phase and work on technology, product, and service development is done, integration and testing is performed, and pilot preparations are initiated. Also the market plans as well as the next phase plan are drafted.

The steering group reviews does the intended pilots meet the initial specifications, and approves the milestone based on the following criteria: content of the pilot is agreed upon; pilot verification is clear; expectations derived at the previous phase are met; next phase plan is ready; and a review of ecosystem performance metrics is done. As a positive outcome the ecosystem prototype is accepted.

3.2.3.5 Ecosystem Pilot Phase and E4 Milestone

The next phase is to gather data by piloting the innovation. Documentation is initiated by filling in the necessary templates. At the same time, plans for change development and commercialisation requirements are created and business case is reviewed once again. Next phase plan with training and communication plans are constructed.

The pilot results are reviewed by the steering group and acceptance is done based on: pilots are functional and the data is available; expectations are met; the next phase plan is ready concerning re-piloting, training and communication; and the public results and demos are agreed upon. A positive outcome is that the pilot is accepted.

3.2.3.6 Documentation for Commercial Phase and E5 Milestone

The final phase is about dissolution of the project and preparing for commercialisation. Core change implementation evoked from the previous phase is to be done; testing of these changes as well as transfer actions and learning are propagated. Also expansion plans and support plans are developed. Finally the documentation is finalised regarding the created system, and necessary reports for funding organisations are accomplished. Seminars and publications are of course done as well.

Steering group reviews the ecosystem against the expectations. Requirements for acceptance are: expectations of this phase are met; responsibility is shifted from program manager to participants; reports are written and distributed; and the case is documented. As an outcome, the ecosystem is tested, transfer is completed and program organisation is dissolved.

3.2.4 Applicability to Literature Frameworks

The presented literature in Chapter 2 gives some good viewpoints to see from where this (Concurrent) Ecosystem Creation Process has arisen and to what principles does it hold. As said in Chapter 3.2.1, this process framework is not brand new, but it is based on product development framework(s) used in one global and successful ICT-company, therefore it can be assumed to be functional and well-designed at least in the context of that particular company.

The process has many similarities to Cooper's stage-gate -process presented in Chapter 2.3.1. It is clearly a linear and systematic process where Go / No-Go decision is made in each milestone i.e. gate. Concurrent work method was also enthroned in the process, and there are clear links to Concurrent Engineering ideas as illustrated in Chapter 2.3.2 even though in the process picture the phases are anything but parallel. The idea is that concurrent activities are done within each phase, as work groups advance their work simultaneously.

The context of business ecosystem can be seen quite similar as depicted in the literature (Chapter 2.1.2), since the basic fundamentals, interconnectedness and co-opetition, exists, although no clear definition of business ecosystem is produced in any material regarding the process. Term "ecosystem" is used in multiple ways indicating the innovation itself, the project and/or the wider business outcome. This ambiguity can be seen also in the way how participants defined the term – in most variable ways.

The basic idea behind the process is alike Open Innovation paradigm (Chapter 2.4.2) since development is done via network and shared knowledge is assumed to be premise from all the participating players. Also the basic role of Tivit as a facilitator in the transfer of research into real business corresponds to the core ideas of Open Innovation thinking.

3.3 Conduct of the Case Study

The data collection was conducted by interviewing relevant persons inside the case project, from Tivit Ltd., and from outside the project but still with relevant connection to project aims. Five people in total were interviewed and the total time recorded was about 4 hours and 42 minutes. Information was gathered also from other material, such as the Project Plan and its appendixes, and from the Internet. From the project personnel, Tivit's CEO, the Programme Manager and a contact person from each of the participating companies was interviewed. Outside the project one "Vice President, Products and Services" from a clearly potential Service Provider was interviewed. In parallel, the Ecosystem Creation process was analysed with three students groups (each group 3-4 person, total 10 persons) in general with two different perspectives:

- The key incentives of participating companies and simulated case of the process
- The role and benefit of lead-user approach

The basic idea of this student approach was to gather information and evidence relevant to the case and the (Concurrent) Ecosystem Process, but from the people that do not represent the project participants to gain more objective and fresh outlooks.

The interviews were held as semi-structural interviews person to person, and with the student groups as workshops. The student group did also independent written findings and these were analysed by the author. The interview method was chosen because it enables to react to new themes and branches that arise unexpectedly during the interview. Still it gives a framework that enables to compare the data and use it to find relevant similarities or conflicts. The workshop method for the student groups was seen as the best alternative because of the large number of participants and also the need for creativity and openness to suggestions.

All the interviews were carried out in a short interval, from October to December 2009. Work with student groups was done from November 2009 to the beginning of January 2010 and it was part of the Helsinki University of Technology course "Strategic Management of Technology and Innovation, 2009 Fall" (in which all students participated). The interviews were analysed in December 2009 and the student group results analysed in the beginning of January 2010.

4 Results

Results are drawn from the empirical data gathered, from which common patterns and relations emerge. Linkages to the literature are commented in this section already, but more thoroughly they are analysed in Chapter 4.5. Results are categorised into four different groups. The first group provides background information regarding the course of the project and show how the main concepts of the process are understood. The next two groups are direct answers to the research question specified in Chapter 1.2. The last group consist of results that were not specifically sought after in this thesis but which still are relevant material for future studies. The references in each claim are to point out the main source, but nearly always they are confirmed from other sources as well – direct citations are only from the person in question.

4.1 Background results

The formal process using Ecosystem Creation model has began spring 2009, although at the beginning of 2009 there was a task force of different actors (some were not involved later on) to advance and consider how to proceed with the innovation. The process went from E0 to E2 phase in about six months, starting from the beginning of March 2009 to end of August 2009. The three final phases were planned to be accomplished by the end of March 2011. The process took a sudden turn on the late autumn 2009: a negative funding decision altered and divided the project from a single process to be embedded into one of Tivit's SRAs and to participants' own (product) development. So worth this particular ecosystem creation process ended in December 2009 and the work continued in other forums.

The business ecosystem concept was understood in many different ways. The most straightforward one was that it consists of actors and the goal is new business, as described by the program manager. Another perspective, by one of the participants, was that it compromises a certain specific country of cultural region that adapts the innovation/technology. In this specific case, it meant that in Finland all the

Technology Providers, not just the process participants, decide to drive this technology onward. A third view, based on analogy to nature, was that ecosystem is balanced and long-term business system of multiple participants, where no party has a dominant role and system creates benefit to all. It is developed by time and it cannot be created by a single company. The last perspective was characterised by the facilitator (Tivit), in which the created ecosystem lives on and develops by itself. All in all, the term business ecosystem was not entirely understood as defined in Chapter 2.1.2. Still the main ideas presented in literature, interconnectedness and co-evolution, were indentified also in this case.

The interviewees regarded co-opetition as relevant: the business characteristic to this case requires cooperation even though competition is also present. Differentiating itself from competitors was planned to be done in the future business ecosystem by company-specific value-added services, e.g. more usable interfaces and so on.

4.2 Process Speed

Many interviewees expressed the opinion that the process model's benefit in general, and especially regarding the speed, is that there is such a model in the first place. Consequently, it is not necessary to reinvent the wheel all the time. But otherwise the process phases and milestones in the Ecosystem creation process are not considered to be "universally applicable" as one of the interviewees, an experienced project manager, expressed. A comment by a research engineer in one of the companies condenses it as follows:

> *"The value that the (Ecosystem creation) process creates is that is shows the way, supports decisions and enhances coordination."*

The main criticism was directed to the fact that the process was not tailored to this case; the characteristics were not considered enough – one interviewee saw that this model was more created to software development project than a network-based "national project". The process model on the other hand was considered to be familiar, since it was constructed from common and practical components, such as demos and pilots, and the order or sequence sounded and felt reasonable. Many interviewees said that this model is, with some minor modification, used in their company's own development work. Still the process-model was not applied exactly in this case. Some milestones were accepted with inadequate preparation and documentation as funding application deadlines were closing in. None of the interviewees' could give a clear answer to how this model supported, or hindered, network-based development work. Many stressed the fact that this project was a pilot project regarding the process-model. As a conclusion from the facts that the process-model was not even truly obeyed and all statements were so neutral, *no evident benefits* occurred from this model in this context.

The interviewees told that parallel work with the work packages reduced the throughput time. Work groups advanced their work simultaneously and quite independently. Also specific tasks in some cases were done inside the work groups concurrently. The groups reported their work, and the situation was always reviewed in the steering group meetings. As four of the five work packages were contributed by the same participants and the last one was quite disconnected compared to the other work packages, there were *no detected* problems regarding complex information exchange or similar dependency problems presented in Chapter 2.1. The parallel work inside the phases was considered a natural way to proceed; its effect for shortening the throughput time was seen as self-evident. This reasoning emerged from the past experiences of the participants, not from the process-model itself.

The involvement and activity of critical Service Providers – those that planned to be the first ones to adapt the technology – was considered to have an impact on the speed of the development. This is understandable due to the fact that the final technology is not worthwhile to be launched before it is seen that critical players adapt it. If those players are not actively involved, then a lot of energy, effort and time are consumed to see whether the innovation is suitable to their perspective. This is similar thinking as in the lead user approach presented in Chapters 2.3.3 and 2.4.1.

4.3 Success Factors

Changes in the business environment are seen relevant to either working assets, e.g. financial problems, or to the future business ecosystem, which all have a major impact on the success of the project. This is hard to predict at the outset but by active monitoring and real-time analysis it can be tackled to some extent.

At the beginning of the process, there were more discussion about the success factors and commitment to the project. It was gathered from the participants' organisations actively. After commitment was achieved and the phase E1 started, the discussion about the success factors among the participants diminished clearly. In the end, the lack of commitment from the participant companies was not recognised or seen as a contributing reason in the dissolution of the project. As a conclusion, active *investment of time and effort into engaging the players into a common goal at the beginning increases the success*. This is especially important when the participant companies are large, and therefore inner inertia of corporate structure is great. If in the beginning there is no clear and formal engagement, then there is a real risk of actors withdrawing in later phases, when the consequences of this can be more severe than in earlier phases.

Business model obscurity and especially the logic of profit and earning model incompleteness were seen as threat to success. The business model was not arranged in phase E2 as the process model required, because Companies A and B could not agree on that and funding deadline required the phase to be completed. The business model was still unclear when the project dissolved. The main problem was indentified on the fact that the service to end-users could be interpreted as a "public utility" since there exists alternative solutions that are free of charge to the end-users. Although the developed service could be characterised as superior to its competitors in general (if operational), the premium to the end-users was not as clear, and in the value-chain also the role of the Service Provider, regarding costs and compensation, was not agreed on. In context of network of companies the *creation of the business plan was seen as a problem in general,* since the participators where not indulged to reveal financial information for a good profitability analysis.

It was seen that the process model drives *a more evolutionary than revolutionary approach* to innovation development, as the project facilitator put it: *"In this case the goal is to gain evolutionary, step-like, development of know-how and business"*. This was recognised as a risk to drive the project into a narrow and constricted outcome. On the other hand, it was seen that this evolutionary aspect decreases the risk involved, since the actors know how to operate efficiently in the development context, and phases can be carried out at the first place. This of course reduces the possibility of "jack-pots" – meaning real breakthroughs.

Key point identified was the importance of *formal agreement*: a written document describing how the co-operation continues and how the business model tackles e.g. the IPR -aspect. Especially with large companies, such as those participating in this case, it is "show stopper" if an agreement is not established early on. Without an agreement the real co-operative work cannot start. This was the situation in this case, where work was done by the participant themselves before the contract and expected funding decision was received. And when the decision eventually dissolved then the real co-operative work did not arise at all.

When developing innovation in networks with many organisations, policy issues come to the fore; they may even play a larger role than the technology itself. The biggest issues were seen within the players themselves and their large organisational approval, as the program manager stipulates. Selling the idea of development work within a big organisation and receiving commitment was considered even more important than selling it to outsiders. The legal aspects were considered to be especially hard. That means *"how to get the lawyers to speak the same language"*, as one interviewee put it. This inertia of large corporations was accepted to be an existing fact in this case, but *in general one hypothetical conclusion from this is that with smaller organisations likelihood of quicker throughput-time is larger*.

It was an unanimous view that the success is depended on how the Service Providers adopt the technology provided by Companies A and B. Especially some very widely used services provided by the Company E were seen crucial. Its utilisation and diffusion of this technology to the end-users was considered critical. Service Providers were not able to participate in the examined process except for the future pilots, because the group was considered to be too large. However, the Interest Group exists just for this purpose: those parties were represented and their needs analysed in this group to some extent.

User needs were analysed and seen as success factors, when other failed projects, done by the participant companies by themselves (see Chapter 3.1), were considered and learned upon. User involvement, both the Service Providers and the end-users, was planned to occur in the pilot phase E4. This was designed to be done within those organisations which have their own user development groups and employees as first users. User engagement was considered vital in the project plan, and the selling work of this base-technology for service providers was done before the project, years ahead. Users were taken into account somewhat in the development work before the process eventually started, because in the initial discussions there were some representatives of users, but the group faded away quite soon. The process of user involvement in this case could not be described to function as the lead user or rapid application method depicted in Chapters 2.3.3 and 2.4.1. One reason for this is that Company E, a clear lead user candidate, was not so eager to participate on projects of this kind. Lead user -perspective, extended to other players than just Company E, could still give some input on developing more successful innovation, according to one Vice President of a Service Provider not participant in the process. One result from the student group analysis was that in the context of networks, the cost of complexity generated from lead users has a risk of being too high versus the benefit received. This could therefore diminish the total success rate.

4.4 Results outside the Research Questions

In this case there exists an interesting viewpoint regarding the SHOK-programme and how spin-offs emerge from that kind of a development programme. The SHOK-programme in question was in the field of ICT. In it, Tivit has created a unique model of facilitating new innovations from its Strategic Research Agendas, which by nature are more research than business orientated. This (Concurrent) Ecosystem Creation Process model is a systematic way to drive network-based innovation onwards. Ecosystem creation projects are seen hard to accomplish, because in the background there are always conflicts of interest and other disputes, but it was seen that neutral process framework helps to overcome these time-consuming obstacles and thus drive the process on. One interviewee described the situation as follows:

> *"The greatest additional value of the process is that it makes all the players, even competitors, to work with each other in a reasonable and practical way. Ecosystem creates new business, not just little step by step improvement, but a common new breakthrough."*

Research done in the SRAs is not by itself generated into new business innovations, and the prevailing culture demands a lot of work for a paradigm change so that new inventions emerge with the initial purpose to be driven on to real businesses. The process offers a framework in which development work could be conducted. It does not, however, tackle the issue of how the necessary network of players are gathered behind the ideas – the question of the fuzzy front end process (see Chapter 2.4.1).

The case process ended before it was completed as planned, and one key problem was the formal agreement dilemma which combined by a negative funding decision by TEKES eventually forced Company C to continue developing its Work Package by itself rather than inside one SRA, as the Companies A and B did. When operating in a TEKES funded environment, the procedures are quite clear, especially in larger firms, but when funding differs from that, the formal agreement was seen crucial for co-operation to continue.

When analysing the (Concurrent) Ecosystem Creation Process from outside, it lacks some of the basic analysis tools created in the current innovation theory. The student work indicated that analysis of network effect and network externalities, complementary assets and appropriability regime are points that are not evident in the process. Feedback loops and iterative methods are missing from the process and it was evident in simulation that this created problems and could lead to unnecessary work and poor results. Eventually the process was very conventional regarding the present-day paradigms, and concepts such as *discovery drive planning* and *shaping strategy* should be considered (Vega, Tahvanainen and Enarvi 2009). Key incentives from the players can perhaps be analysed at the beginning, but when complexity arises and situations alters constantly, it comes more and more difficult (Meriläinen, Ristimäki and Silen 2009).

4.5 Discussion and Criticism

Though the process in a way did not create a successful innovation, now that the work broke up into different forums, it gave good points regarding the research questions in the view point of what are the perils of this kind of development work. The data assembled gave a versatile prospect to the case, process framework in it and future ecosystem to that extent that results can be seen as relevant and valid. The context of the thesis is ICT-sector innovation and development process within a business network. Results drawn are generally more applicable to larger than smaller firms on the grounds that all the companies in the case where big companies. This should be kept in mind when applying the results on other targets.

The literature review unveils certain aspects regarding the research questions defined at the beginning. First, a systematic or state-gate process creates a good framework for sieving out unsuccessful projects when the process is carried out accordingly. But for acceleration it gives only a small benefit, mostly by giving a solid working environment for driving the task one by one. Parallel working on the contrary gives good ways to speed up the process by enabling simultaneous work of different phases. But as a drawback it makes the management more complex and may hinder the evaluator's possibility to see unsuccessful projects or at least increases the probability of extra work, when a critical failure in one phase does not prevent others to continue working. Fast prototyping and adaptive learning emphasises instant feedback and iterative work with the pilot customers. This accelerates the process so that the innovation is sooner in the hands of customers, although maybe in a semi-ready condition. Adaptive learning also increases the success of innovation when it is in a turbulent and unknown atmosphere, but decreases the effectiveness in the context of more mature market. User centric view enables more relevant input from future customers so that the innovation finalised and commercialised is suitable for the target market, and redesign is minimised. Also the complexity of management and the ambiguity of final innovation may hinder the results gained.

The empirical data confirms that the systematic process used gave benefit to the development work by giving a clear protocol to follow. Still, it was not followed accordingly and perhaps this bypassing of acceptance criteria, in the motive of accelerating the process, deteriorated the success factors in general. Parallel working was seen as a relevant factor when considering the speed of the process. In the case-project, parallel tasks did not increase the complexity because dependencies were still quite modest. Prototyping and the utilisation of users were, in a way, built-in to the process, since pilot phase was the key output of it. During the development work user input or prototyping were absent. From the case results the following themes emerges as dominant results:

Formal agreement is an essential factor not only to the success of the innovation, but to the lifespan of the network-based innovation project in the first place. Agreements should be done at the earliest possible phase.

There are no good examples from the literature about network based innovation processes; concentration is mainly about single-company innovation development or network-based innovation outcome. Data gathered in this thesis indicates that in large and established companies, no new network-based development is done without formal agreements or else without an authorisation from high management. In smaller firms the case could be different, but that cannot be confirmed with the data collected.

In a technology innovation, where the business model is based on services run by third parties with high end-user penetration, the commitment of the main third parties is crucial for the success of the innovation. The key third parties should be identified and involved in the development process as early as possible.

The literature supports the idea of the lead user involvement benefits in the success and speed of the process. This is based also in the importance of complementary assets when striving for a dominant design. When the ecosystem has some Service Providers that have a very high user penetration, then empirical data collected suggests that these players should be introduced, involved and engaged to the development work at the earliest possible phase. The lead user paradigm suggests more than just informing the key users as in this case; it requires that these users are "hands-on" in the project. If this cannot be accomplished for some reason, it gives a strong negative signal about the success probability of that project.

A linear and systematic innovation process, in the context of network development, gives only small input to minimise the throughput-time or to maximise the success of the innovation.

As the case results show, the only benefit for acceleration from a linear and systematic innovation process is that it exists and is familiar to the participants. Not a single attribute or feature of it, drives the innovation in a more apace way. In the literature, models of better results in throughput-time are presented, such as the rapid prototyping, the adaptive learning or the fully enforced concurrent engineering (or parallel activities). The linear model has benefits regarding to the success rate, but only when it is applied exactly, e.g. if in the name of accelerated process some corners are cut, then usefulness of the process diminishes. This is quite plausible, considering that in a network environment the complexity normally arises. Thus, the bureaucratic action to manage the situation is aggravated, and so worth inertia increases, giving larger change or temptation for fast tracking.

As for criticising the empirical data, it can be stated that it was depended on a single case, which was not even completed, and is thus quite limited. Also most of the interviews were held when the process was still ongoing. As said also in the beginning of this chapter, the case was an illustrative example that gave unique information about research question formulated considering the context of this thesis. Because this is only a single-case study, the findings cannot be verified and no quantitative analysis can be conducted. But those were not the goal or in the scope of this thesis.

In the literature review, the basis of incorporating the product and service development into one, could be criticised. Johne and Storey (1998) summarise that in the literature the difference between "new product development" and "new service development" is emphasised. Some suggestions have been made that claim that new product development needs as much service development as for old-fashion product development, e.g. Harvey-Jones (1988). The main differences between product and service development are according to Johne and Storey (1998)

Intangibility; *Heterogeneity*; and *Simultaneity*. Considering these points and the findings in the previous chapters, it can be argued with credible plausibility that findings are not affected by the premise that product and service developments were considered simultaneously.

5 Conclusions

Findings presented in this thesis sought to answer these two main research questions:

i. What factors affect the throughput-time of a business model innovation targeted to create a new business ecosystem in the ICT sector?
ii. What factors create a successful new business ecosystem in the ICT sector and how can these factors be used in evaluating the ecosystem propositions?

The results derived from the case and the literature were as follows. *Linear and systematic innovation process gives only small benefit to the speed the process.* Instead *parallel activities* and the use of *lead users* are seen relevant regarding the speed of the process. The critical success factor indentified was the *formal agreement* between the participants created as early in the process as possible. Another success factor was that the *use of key outside players*, which possess critical complementary assets or/and high penetration to the end-user market, was important. Existence of an agreement can be easily monitored but deeper analysis is always required to recognise the key outside players of a specific innovation.

5.1 Scientific Evaluation

This thesis is based on single-case approach where the case in question is an illustrative and at the same time unique example of a network innovation process in the ICT sector. From the case combined with extensive literature analysis, derived results suggest more profound research into network innovation process. The literature is scarce about the process regarding networks doing innovation processes, and thus the three main results can be announced to be novel at least to some extent. Future research conducted in this field shows how applicable they are.

The work was conducted with diligence and fidelity. The relevant literature and the case was examined in all possible means, and validity and reliability were achieved by triangulation method and with chain of evidence described in more detail in Chapter ii. Thus, the results can be put forward into more thorough future examination.

5.2 Managerial and Practical Implications

In the level of companies, network-based innovations are more and more relevant and common as knowledge disperse, and centralised funding is concentrated into larger entities where no single company can do all by itself. Also real breakthrough innovations eventually lead into business ecosystems, and to incorporate those future players at the beginning can lead into a better success, and at least into more cost effective development. In this perspective, it is important to see the key factors behind fast and successful innovation process. As a recommendation for company managers running or participating on these projects, is to select the most appropriate model to the case in question. It should be considered that in a complex environment a linear model might not be the most effective one. On the contrary, there exist many other models, like the lead user approach, fast prototyping, and adaptive learning, just to mention a few. When working in a network, the basic principles of business ecosystem, value network and open innovation paradigm, should be considered and used in a communicative manner so that all the participants are in the same wavelength and know what to expect.

Tivit Ltd. has done a lot of work to develop a pilot process model for creating new ecosystem from its SRAs. This thesis reveals that there is much good in it, especially in its spirit and goal for creating new breakthroughs. The process is based on very common model of stage-gate -type of progress. But it does not take into consideration the complexity of network-based innovation development or the benefits of (lead) user involvement in earlier phases or the use of feedbacks and iterative progress methods. All these points should be considered when developing the model onwards into even better and more robust tool.

5.3 Future Research Areas

As for future research areas, it is recommended that network-based innovation process is studied more thoroughly in a similar fashion than a single company product or service development is studied. The literature review reveals that this area is quite uncharted.

The main deficiency of this thesis is the lack of quantitative data. Hence comparative studies of these findings should be conducted with preferably wider and more diverse forms of data. This particular (Concurrent) Ecosystem Creation Process should also be studied further to see how well it really supports the network-based development work. Also as a single point to focus is the fuzzy front end of a network-based innovation development. In this thesis a clear need for more formal and adequate research in that area was indentified.

6 Summary

In this thesis, the acceleration and the success rate of the network-based innovation process in the ICT sector was examined. Work included a literature review and as an empirical background the case-study of a single network-based innovation process in ICT-sector.

From the literature review, it was concluded that the network-based *innovation process* has not been extensively studied, which was so worth identified as a prime future research area. The main conclusions from the literature were that the lead user approach, parallel working, fast prototyping and adaptive learning all have a positive impact on the speed and success of the process.

The case study was conducted as single-case of a pilot project for (Concurrent) Business Ecosystem Creation Process developed by Finnish ICT-SHOK programme company, Tivit Ltd. The case study included gathering background information, semi-structural person to person interviews and workshops with people not involved in the project. This was done in pursuit to gather enough empirical evidence.

The project in the case study started in spring 2009 and ended in December 2009. It was by nature a business model innovation in pursuit to establish a new business ecosystem. The project was not completed altogether according the process model due to funding problems. It still continues in different forums with somewhat different participants and scope. Regardless the fact that the process was not completed, interviews and background thesis revealed many novel aspects considering the research agenda of this thesis. Main findings were that formal agreement among the participants should be the primary task to be implemented as soon as possible, since without it the process has a poor lifespan. Another perspective was that in a business model innovation, the involvement of the key third parties, with complementary assets, is critical to success. It was also found out that a linear stage-gate -method does not by itself have impact on the speed or the success of the process.

7 Appendixes

SEMI-STRUCTURED QUESTIONS FORM

References

Achrol, Ravi S. "Changes in the theory of interorganizational relations in marketing: Toward a network paradigm." *Academy of Marketing Science. Journal. Vol. 25, Iss. 1,* 1997: 56-72.

Ainscough, Matthew, and Baback Yazdani. "Concurrent Engineering within British Industry." *Concurrent Engineering, Vol. 8, No. 1,* 2000: 2-11.

Alam, Ian, and Chad Perry. "A customer-oriented new service development process." *Jounal of Service Marketing, VOL 16 NO. 6,* 2002: 515-534.

Anderson, Philip, and Michael L. Tushman. "Technological discontinuities and dominant designs: a cyclical model of technological change." *Administrative Science Quarterly, Vol. 35,* 1990: 604–633.

Ashkenas, Ron, Dave Ulrich, Todd Jick, and Steve Kerr. *The Boundaryless Organization: Breaking the Chains of Organizational Structure.* San Francisco: Jossey-Bass Publishers, 1995.

Atkins, M. H. "The role of appropriability in sustaining competitive advantage—an electronic auction system case study." *Journal of Strategic Information Systems 7,* 1998: 131-152.

Barnett, H. G. *Innovation: the basis of cultural change.* New York: McGraw-Hill, 1953.

Booz, Allen & Hamilton. *Management of New Products.* New York: Booz, Allen & Hamilton Inc., 1968.

—. *New Products Management for the 1980s.* New York: Booz, Allen & Hamilton Inc., 1982.

Brandenburger, Adam M., and Barry J. Nalebuff. *Co-opetition.* London: HarperCollins, 1996.

Brown, Shona L., and Kathleen M. Eisenhardt. "Product Development: Past Research, Present Findings, and Future Directions." *The Academy of Management Review, Vol. 20, No. 2,* 1995: 343-378.

Chan, Su Han, John W. Kensinger, Arthur J. Keown, and John D. Martin. "Do strategic alliances create value?" *Journal of Financial Economics 46*, 1997: 199-221.

Chesbrough, Henry W. *Open innovation : the new imperative for creating and profiting from technology.* Boston (MA): Harvard Business School Press, 2003.

Chesbrough, Henry W., and David J. Teece. "When is Virtual Virtuous? Organizing for Innovation ." *Harvard Business Review, Vol. 74 Issue 1*, 1996: 65-73.

Clark, Kim B., Bruce Chew, and Takahiro Fujimoto. "Product Development in the World Auto Industry." *Brookings Papers on Economic Activity*, 1987: 729-781.

Cleetus, K. J. *Concurrent Engineering Vision.* Research Note CERC-TR-RN-92-018, Morgantown, WV: Concurrent Engineering Research Center, West Virginia University, 1992b.

Cleetus, K. J. *Definition of Concurrent Engineering.* Technical Report CERC-TR-RN-92-003, Morgantown, WV: Concurrent Engineering Research Center, West Virginia University, 1992a.

Coates, Graham, Alex Duffy, Ian Whitfield, and William Hills. "Engineering management: operational design coordination." *Journal of Engineering Design, Vol. 15, No. 5*, 2004: 433-446.

Cohen, Wesley M., and Daniel A. Levinthal. "Absorptive Capacity: A New Perspective on Learning and Innovation." *Administrative Science Quarteriy, 35*, 1990: 128-152.

Cooper, Robert G. "Developing new products on time, in time." *Research-Technology Management, Vol. 38*, 1995: 49-57.

Cooper, Robert G. "Doing it Right: Winning With New Products." *Ivery Business Journal, Vol. 64, No. 6*, 2000.

Cooper, Robert G. "New Product Strategies: What Distinguishes the Top Performers?" *Journal of Product Innovation Management Vol. 1*, 1984: 151-64.

Cooper, Robert G. "Predevelopment activities determine new product success." *Industrial Marketing Management, Vol. 17, Issue 3*, 1988: 237-247.

Cooper, Robert G. "Stage-Gate Systems: A New Tool for Managing New Products." *Business Horizons*, 1990: 44-54.

Cooper, Robert G. "The new product process: an empirically-based classification scheme." *R&D Management Vol. 13, Issue 1*, 1983: 1-13.

—. *Winning at New Products: Accelerating the Process from Idea to Launch.* Reading Massachusetts: Persues Books, 1993.

Cooper, Robert G., and Elko J. Kleinschmidt. "An Investigation into the New Product Process: Steps, Deficiencies, and Impact." *Journal of Product Innovation Management, Vol 3*, 1986: 71-85.

Cooper, Robert G., and Elko J. Kleinschmidt. "Benchmarking the Firm's Critical Success Factors in New Product Development." *Journal of Product Innovation Management*, 1995: 374-391.

Cooper, Robert G., and Elko J. Kleinschmidt. "New Product Process at Leading Industrial Firms." *Industrial-Marketing-Management, Vol. 20, No. 2*, 1991: 137-148.

Cooper, Robert G., and Scott J. Edgett. *Product Development for the Service Sector.* New York: Perseus Books, 1999.

de Brentani, Ulrike. "Innovative versus incremental new business services: Different keys for achieving success." *The Journal of Product Innovation Management 18*, 2001: 169-187.

de Vries, Erik J. "Innovation in services in networks of organisations and in the distribution of services." *Research Policy 35*, 2006: 1037-1051.

Drejer, Ina. "Identifying innovation in surveys of services: a Schumpeterian perspective." *Research Policy 33*, 2004: 551-562.

Eisenhardt, Kathleen M. "Building Theories from Case Study Research." *Academy ofManagement Review, Vol 14, No 4*, 1989: 532-550.

Eisenhardt, Kathleen M., and B. M. Tabrizi. "Accelerating Adaptive Processes: Product Innovation in the Global Computer Industry." *Administrative Science Quaterly, Vol. 40*, 1995: 84-110.

Engwall, Mats, Peter Magnusson, Cassandra Marshall, Tommy Olin, and Robert Sandberg. "Creative Approaches to Development: Exploring Alternatives to Sequential Stage-gate Models." *Fenix WP 2001:17, Available on-line at http://www.fenix.chalmers.se*, 2001.

Foster, John, and J. Stanley Metcalfe. "Modern evolutionary economic perspectives: An overview." In *Frontiers of evolutionary economics: Competition, self-organization and innovation policy*, by John Foster and J. Stanley Metcalfe, 1-16. Cheltenham, UK: Edvard Elgar Publishing Limited, 2001.

Foster, Richard N. *Innovation: The Attacker's Advantage.* New York: Summit Books, 1986.

Freeman, Christopher, and Carlota Perez. "Structural crisis of adjustment, business cycles and investment behaviour." In *Technological Change and Economic Theory*, by G. Dosi, C. Freeman, R. Nelson, G. Silverberg and L. Soete, 38-66. London: Pinter, 1988.

Gallouj, Faiz, and Olivier Weinstein. "Innovation in services." *Research Policy 26*, 1997: 537-556.

Glaser, B., and A. Strauss. *The discovery of grounded theory: Strategies of qualitative research.* London: Wledenfeld and Nicholson, 1967.

Gruner, Kjell E., and Christian Homburg. "Does Customer Interaction Enhance New Product Success?" *Journal of Business Research, Vol. 49, Issue 1*, 2000: 1-14.

Gulati, Ranjay. "Alliances and Networks." *Strategic Management Journal, Vol. 19, No. 4, Special Issue: Editor's Choice*, 1998: 293-317.

Gunasekaran, A. "Concurrent engineering: a competitive strategy for process industries." *Journal of the Operational Research Society, Vol. 49, No. 7,*, 1998: 758-765.

Gupta, Ashok K., and David L. Wilemon. "Accelerating the Development of Technology-Based New Products." *California Management Review*, 1990: 24-44.

Hagel, John, and Marc Singer. "Unbundling the Corporation." *Harvard Business Review, Vol. 77, Issue 2*, 1999: 133-141.

Hagerdoon, John, Albert N. Link, and Nicholas S. Vonortas. "Research partnerships." *Research Policy, Volume 29, Issues 4-5*, 2000: 567-586.

Hamel, Gary, Yves L. Doz, and C. K. Prahalad. "Collaborate with Your Competitors - and Win." *Harvard Business Review*, 1989: 133-139.

Handfield, Robert B. "Effects of Concurrent Engineering on Make-to-Order Products." *IEEE Transactions on Engineering Management, Vol. 41, No. 4*, 1994: 384-393.

Haque, Badr. "Problems in concurrent new product development: an in-depth comparative study of three companies." *Integrated Manufacturing Systems 14/3*, 2003: 191-207.

Harvey-Jones, John. *Making It Happen: Reflections on Leadership.* London: HarperCollins, 1988.

Hedaa, Laurids. "Black holes in networks." *Advances in International Marketing, 9*, 1999: 131-148.

Howells, Jeremy. "Services and Innovation and Service Innovation: New Theoretical Directions." In *The Handbook of Innovation and Services*, by Faiz Gallouj, Faridah Djellal and Camal Gallouj. Cheltenham: Edward Elgar, 2009.

Iacobucci, Dawn. *Networks in Marketing.* California, London: Sage Publications, 1996.

Iansiti, Marco, and Alan MacCormack. "Developing products on Internet time." *Harvard Business Review*, 1997: 108-117.

Iansiti, Marco, and Roy Levien. "Strategy as ecology." *Harvard business review vol:82 iss:3*, 2004: 68-78.

Jaworski, Bernard J., and Ajay K. Kohli. "Market orientation: Antecedents and consequences." *Journal of Marketing, Vol. 57 Issue 3*, 1993: 53-70.

Johne, Axel, and Chris Storey. "New service development: a review of the literature and annotated bibliography." *European Journal of Marketing vol. 32*, 1998: 184 - 251.

Kelley, Scott W. "Developing customer orientation among service employees." *Journal of the Academy of Marketing Science, Vol. 20, No. 1*, 1992: 27-36.

Kim, Jongbae, and David Wilemon. "Focusing the fuzzy front-end in new product development." *R&D Management, Vol. 32, Issue 4*, 2002a: 269-279.

Kim, Jongbae, and David Wilemon. "Strategic issues in managing innovation's fuzzy front-end." *European Journal of Innovation Management, Vol. 5, Issue 1*, 2002b: 27-39.

Kline, S. J., and N. Rosenberg. "An Overview of Innovation." In *The Positive Sum Strategy: Harnessing Technology for Economic Growth*, edited by R. Landau and N. Rosenberg, 275-305. Washington D.C.: National Academy Press, 1986.

Kohli, Ajay K., and Bernard J. Jaworski. "Market Orientation: The Construct, Research Propositions, and Managerial Implications." *Journal of Marketing, Vol. 54 Issue 2*, 1990: 1-18.

Kreiner, Kristian. "In search of relevance: Project management in drifting environments ." *Scandinavian Journal of Management*, 1995: 335-346.

Krishnan, Viswanathan, Steven D. Eppinger, and Daniel E. Whitney. "A Model-Based Framework to Overlap Product Development Activities." *Management Science Vol. 43, No. 4*, 1997: 437-451.

Kuhn, Thomas. *The Structure of Scientifc Revolutions, 2nd ed.* Chicago: University of Chicago Press, 1970.

Lancaster, Kevin. "A New Approach to Consumer Theory." *The Journal of Political Economy, Vol. 74, No. 2*, 1966: 132-157.

Lewin, Roger. *Complexity: life at the edge of chaos.* Chicago: The University of Chicago Press, 1999.

Liebeskind, Julia Porter, Amalya L. Oliver, Lynne G. Zucker, and Marilynn B. Brewer. "Social Networks, Learning, and Flexibility: Sourcing Scientific Knowledge in New Biotechnical Firms." *Organization Science, Vol. 7, No. 4,* 1996: 428-443.

Lovelock, Christopher H. "Classifying Services to Gain Strategic Marketing Insights." *Journal of Marketing, Vol. 47 Issue 3,* 1983: 9-21.

Lüthe, Christian, and Cornelius Herstatt. "The Lead User method: an outline of empirical findings and issues for future research." *R&D Management 34, 5,* 2004: 553-568.

MacCormack, Alan, Roberto Verganti, and Marco Iansiti. "Developing Products on "Internet Time": The Anatomy of a Flexible Development Process." *Management Science, Vol. 47, No. 1,* 2001: 133-150 .

Meriläinen, Eija, Miro Ristimäki, and Robert Silen. *Final Assignment 10 - Tivit Case.* TU-91.2005 Strategic Management of Technology and Innovation, Not Published, Accessible from the Author, 2009.

Merry, Uri. "Organizational Strategy on Different Landscapes: A New Science Approach." *Systemic Practice and Action Research. Vol. 12(3),* 1999: 257-278.

Merry, Uri, and Natali Kassavin. *Coping with uncertainty: Insights from the new sciences of chaos, self-organization, and complexity.* Westport: Praeger Publishers/Greenwood Publishing Group, 1995.

Mickeown, Max. *The Truth About Innovation.* Pearson / Financial Times, 2008.

Miles, Raymond E., and Charles C. Snow. "Fit, Failure And The Hall of Fame." *California Management Review, Vol. 26 Issue 3,* 1984: 10-28.

Moore, James F. "Predators and prey: a new ecology of competition." *Harvard Business Review,* 1993: 75-86.

—. *The death of competition: leadership and strategy in the age of business ecosystems.* New York: Harper Business, 1996.

Moorman, Christine, and Anne S. Miner. "The Convergence of Planning and Execution: Imporvisation in New Product Development." *Journal of Marketing Vol. 62*, 1998: 609-624.

Morrison, Pamela D., John H. Roberts, and Eric von Hippel. "Determinants of User Innovation and Innovation Sharing in a Local Market." *Management Science, Vol. 46, No. 12*, 2000: 1513-1527.

Mowery, David C., Joanne E. Oxley, and Brian S. Silverman. "Technological overlap and interfirm cooperation: implications for the resource-based view of the firm ." *Research Policy, Vol. 27, Issue 5*, 1998: 507-523.

Murphy, Steven A., and Vinod Kumar. "The front end of new product development: a Canadian survey." *R&D Management, Vol.27, Issue 1*, 1997: 5-15.

Murray, Millson R., S. P. Raj, and David Wilemon. "A survey of major approaches for accelerating new product development ." *Journal of Product Innovation Management*, 1992: 53-69.

Myers, Summer, and Donald G. Marquis. "Successful Industrial Innovations." *National Science Foundation, NSF*, 1969.

Möller, Kristian, and Arto Rajala. "Rise of strategic nets — New modes of value creation." *Industrial Marketing Management 36*, 2007: 895–908.

Narver, John C., and Stanley F. Slater. "The effect of a market orientation on business profitability." *Journal of Marketing, Vol. 54 Issue 4*, 1990: 20-35.

Paajanen, Reijo. *TIVIT - presentation 20091018.* 18 10 2009.

Pagie, L. W. P. *Information integration in evolutionary process.* Dissertation thesis, Utrecht: Faculteit Biologie, Universiteit Utrecht, 1999.

Parolini, Cinzia. *The Value Net: A Tool for Competitive Strategy.* Chichester, UK: John Wiley & Sons Ltd., 1999.

Peltoniemi, Mirva. *Business Ecosystem: A conceptual model of an organization population from the perspectives of complexity and evolution.* e-BRC Research Reports 18, Tampere: e-Business Research Center, 2005a.

—. "Co-evolution in an organization population of which knowledge-intensive service organizations form a part." *The Second IEEE International Conference on Services Systems and Services Management (ICSSSM05).* 2005b. 880- 885.

Peltoniemi, Mirva. "Preliminary theoretical framework for the study of business ecosystems." *E:CO Vol. 8 No. 1,* 2006: 10-19.

Peltoniemi, Mirva, and Elisa Vuori. "Business ecosystem as the new approach to complex adaptive business environments." Edited by M. Seppä, M. Hannula, A. Järvelin, J. Kujala, M. Ruohonen and T. Tiainen. *FeBR 2004: Frontiers of e-business research 2004, conference proceedings of eBRF 2004.* Tampere: Tampere University of Technology and University of Tampere, 2004. 267-281.

Powell, Walter W. "Neither market nor hierarchy: network forms of organization." *Research in Organizational Behaviour 12,* 1990: 295-336.

Power, T., and G. Jerjian. *Ecosystem: Living the 12 principles of networked business.* Pearson Education Ltd., 2001.

Rametsteiner, Ewald, and Gerhard Weiss. "Innovation and innovation policy in forestry: Linking innovation process with systems models." *Forest Policy and Economics, Vol. 8, Issue 7,* 2006: 691-703.

Rampersad, Giselle, Pascale Quester, and Indrit Troshani. "Managing innovation networks: Exploratory evidence from ICT, biotechnology and nanotechnology networks." *Industrial Marketing Management,* 2009.

Ritter, Thomas, and Hans Georg Gemunden. "Network competence: Its impact on innovation success and its antecedents." *Journal of Business Research vol. 56,* 2003: 745-755.

Robertson, Thomas S. "The Process of Innovation and the Diffusion of Innovation." *Journal of Marketing, Vol. 31,* 1967: 14-19.

Rogers, Everett M. *Diffusión of innovations (fifth edition)*. Glencoe: Free Press, 2003.

Rosenkopf, Lori, and Paul Almeida. "Overcoming Local Search through Alliances and Mobility." *Management Science 49,* 2003: 751-766.

Saviotti, Pier Paolo, and John Stanley Metcalfe. "A theoretical approach to the construction of technological output indicators." *Research Policy vol. 13, issue 3*, 1984: 141-151.

Scheuing, Eberhard E., and Eugene M. Johnson. "A Proposed Model for New Service Development." *The Journal of Services Marketing*, 1989: 25-34.

Schilling, Melissa A. *Strategic Management of Technological Innovation, Second Edition.* New York: McGraw-Hill, 2008.

Schumpeter, Joseph Alois. *Capitalism, Socialism, and Democracy.* New York: Harper & Brothers, 1942.

—. *The Theory of Economic Development.* Cambridge, MA: Harvard University Press, 1934.

Stacey, Ralph D. *Complexity and Creativity in Organizations.* San Francisco, CA: Berret-Koehler Publishers, 1996.

Sundbo, Jon. "Management of innovation services." *The Services Industries Journal, Vol. 17, No. 3*, 1997: 432-455.

Teece, David J. "Inter-Organizational Requirements of the Innovation Process." *Managerial and Decision Economics, Vol. 10, Special Issue: Competitiveness, Technology and Productivity*, 1989: 35-42.

Teece, David J. "Profiting from technological innovation: Implications for integration, collaboration, licensing and public policy." *Research Policy 15*, 1986: 285-305.

The Science and Technology Policy Council of Finland. *Review2008.* Helsinki: The Science and Technology Policy Council of Finland, 2008.

Tivit Ltd. *TIVIT – Ecosystem Creation Process.* http://www.tivit.fi/en/ecosystems (accessed 12 19, 2009).

Toivonen, Marja. "Different Types of Innovation Processes in Services and Their Organisational Implications." In *The Handbook of Innovation and Services*, by Faiz Gallouj, Faridah Djellal and Camal Gallouj. Cheltenham: Edward Elgar, 2009.

Tuomi, Ilkka. *Networks of innovation: change and meaning in the age of the Internet.* Oxford New York: Oxford University Press, 2002.

Turino, Jon L. *Managing concurrent engineering - Buying time to market.* New York: Van Nostrand Reinhold, 1992.

Tushman, Michael L. "From Engineering Management/R&D Management, to the Management of Innovation, to Exploiting and Exploring Over Value Nets: 50 Years of Research Initiated by the IEEE-TEM." *IEEE Transactions On Engineering Management, VOL. 51, NO. 4,*, 2004: 409-411.

Urban, Glen L., and Eric von Hippel. "Lead User Analyses for the Development of New Industrial Products." *Management Science, Vol. 34, No. 5,* 1988: 569-582.

Usher, Abbott Payson. *A history of mechanical inventions, Revised Edition.* Cambrigde, MA: Harward University Pres, 1954.

Utterback, James M., and William J. Abernathy. "A dynamic model of process and product innovation." *Omega, Vol. 3, Issue 6,* 1975: 639-656.

Van de Ven, Andrew H. "Central Problems in the Management of Innovation." *Management Science Vol. 32, No. 5,* 1986: 590-607.

Wateridge, John. "How can IS/IT projects be measured for success?" *International Journal of Project Management Vol. 16, No. 1,* 1998: 59-63.

Vega, Luis Felipe Del Carpio, Risto Tahvanainen, and Timo Enarvi. *Final Assignment 31 - Tivit Case.* TU-91.2005 Strategic Management of Technology and Innovation, Not Published, Accessible from the Author, 2009.

Venkatesan, Ravi. "Strategic Sourcing: To Make or Not to Make." *Harvard Business Review 70, no. 6,* 1992: 98-107.

Veugelers, Reinhilde, Karl Aiginger, Dan Breznitz, Charles Edquist, Gordon Murray, and Gianmarco Ottaviano. *Evaluation of the Finnish National Innovation System.* Policy Report, Helsinki: Taloustieto Oy (on behalf of the Ministry of Education and the Ministry of Employment and the Economy), 2009.

Winner, Robert I., James P. Pennell, Harold E. Bertrand, and Marko M. Slusarczuk. *The Role of Concurrent Engineering in Weapons System Acquisition.* IDA Report R-338, Alexandria, VA, USA.: Institute of Defence Analysis, 1988.

von Hippel, Eric. "The dominant role of users in the scientific instrument innovation process." *Research Policy,* 1976: 212-239.

—. *The Sources of Innovation.* New York: Oxford University Press, 1988.

Yin, Robert K. *Case study research.* Beverly Hills, CA: Sage Publications, 1984.

—. *Case study research: Design and methods.* London: Thousand Oaks, 2003.

Yin, Robert K. "The Case Study Crisis: Some Answers." *Administrative Science Quarterly, Vol. 26, No. 1,* 1981: 58-65.

Zeithaml, Valarie, A. Parasuraman, and Leonard Berry. "Problems and Strategies in Services Marketing." *Journal of Marketing, Vol. 49 Issue 2,* 1985: 33-46.

APPENDIX

Semi-structured Question Form

Hahmottele omin sanoin *Mobiiliasiointivarmenne -projektissa* mukana olevat tahot ja niiden väliset suhteet. Kerro myös omasta tehtävästäsi.

Mistä tai kenen toimesta projekti käynnistyi? Mikä on projektin tausta?

Miten eri sidosryhmiä on analysoitu ja miten ne ovat huomioitu projektissa?

Kerro omin sanoin mikä on tämän projektin tavoite, kulku tähän mennessä ja jatkotoimenpiteet.

Miten *kehitysprojekti* mielestäsi eroaa normaalista tuotekehityksestä?

Ovatko vastuut ja tehtävät selkeästi määritelty? Ovatko ne muuttuneet matkan varrella? Mikä on TIVIT:n rooli?

Miten ymmärrät (Liiketoiminta)Ekosysteemin käsitteenä tässä yhteydessä?

Kuinka läpinäkyvä on taustalla oleva Ekosysteemin luomisprosessi ollut eri toimijoille? Entä mikä on sen varsinainen vaikutus projektiin?

Meneekö taustalla oleva Ekosysteemin luomisprosessi mielestäsi peräkkäisinä vai rinnakkaisina vaiheina vai niiden yhdistelmänä?

Mitä hyötyä näet, että projektissa on mukana erilaisia toimijoita, verrattuna siihen, että yksi toimija tekisi kaiken itse?

Millä tavalla, jos mitenkään, tämä Ekosysteemin luomisprosessi mielestäsi nopeuttaa projektin valmistumista?

Mitä muita etuja tai haittoja mielestäsi tällä Ekosysteemin luomisprosessilla on projektin toimintaan?

Entä itse lopputulemaan, eli uuteen innovaatioon ja sen menestymismahdollisuuksiin?

Onko loppukäyttäjää ja sovellusten kehittäjiä (jotka tarjoaisivat tunnistamista omissa palveluissaan) huomioitu projektissa? Missä vaiheessa ja kuinka?

Onko aikataulu ollut selkeä, onko se pitänyt?

Onko projektiin liitetty mittareita? Jos kyllä, niin miten näitä mittareita on käsitelty, onko niitä aktiivisesti seurattu? Kenen toimesta?

Mitä kehitettävää näet taustalla olevassa Ekosysteemin luomisprosessissa? Onko selkeitä ongelmakohtia johon pitäisi puuttua? Millaista lisäarvoa se tuo projektiin?

Kuinka todennäköisenä pidät, että tämä projekti onnistuu? Mitkä ovat suurimmat riskit ja kuinka ne huomioitu?